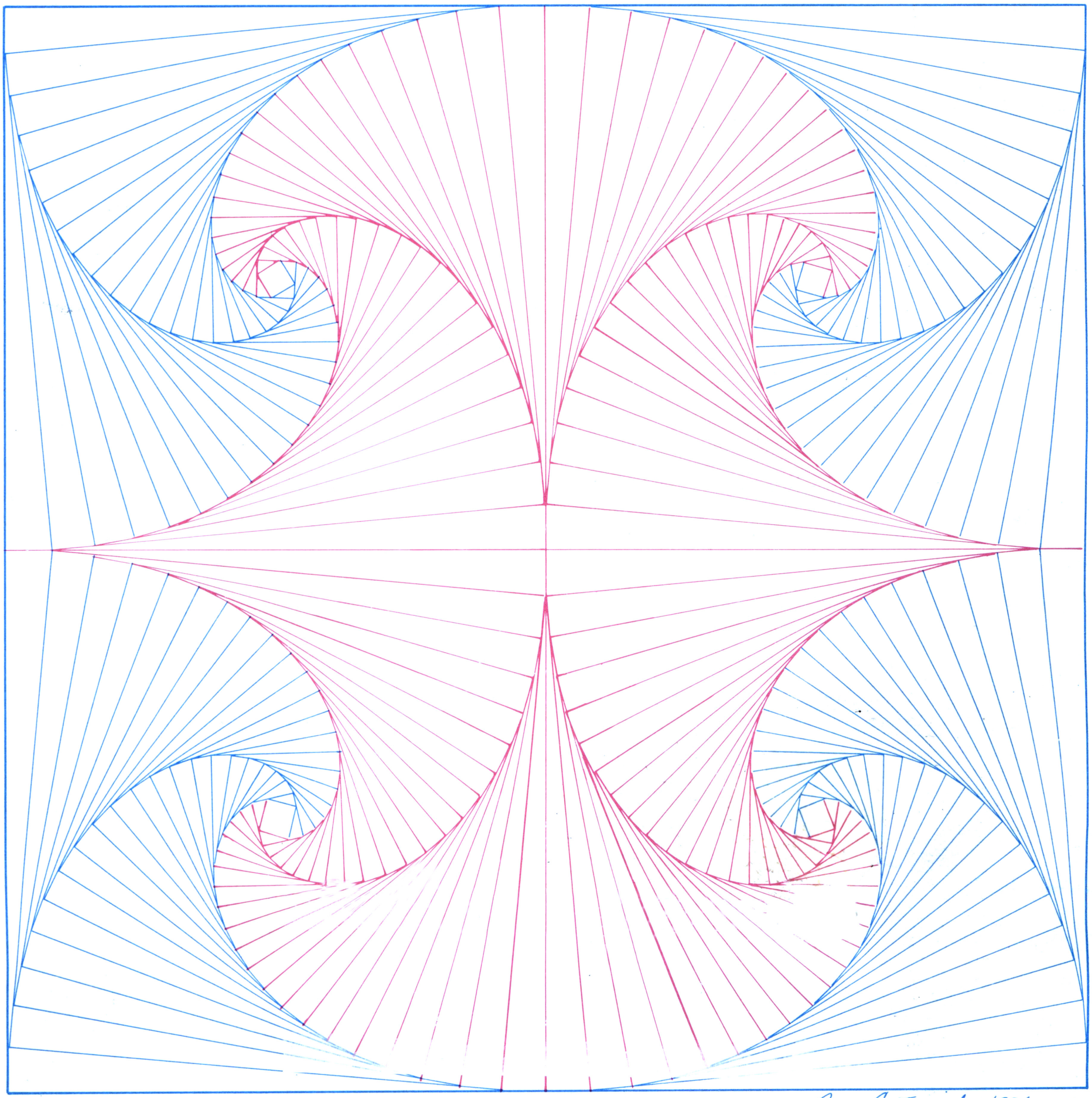
creative computing

the magazine of recreational and educational computing vol 2, no 5 Sep-Oct 1976 $1.50

Do It Yourself Computer Poetry

Amateur Computer Clubs

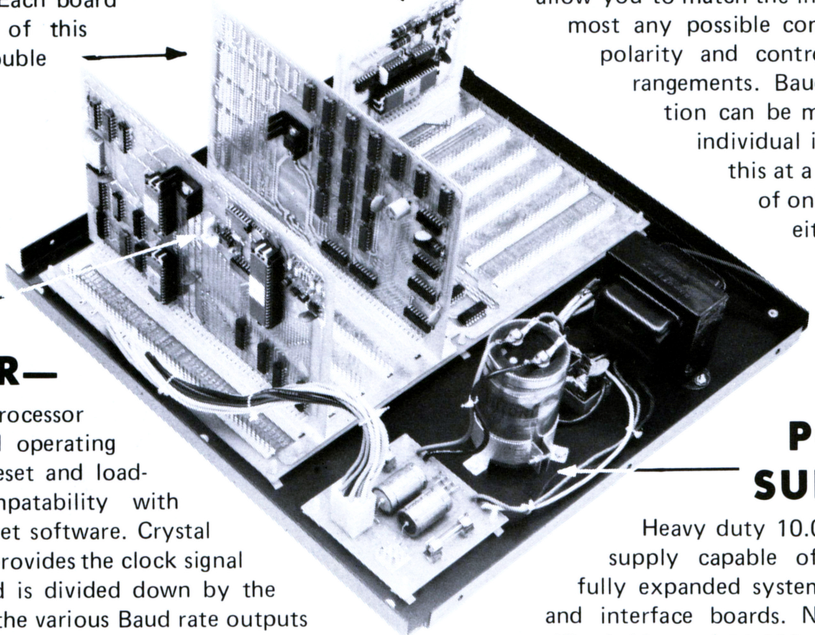


COMPUTERS IN ELECTIONS

Feature Review: Computer Power and Human Reason

Creative Programming Techniques

WHY SETTLE FOR LESS—



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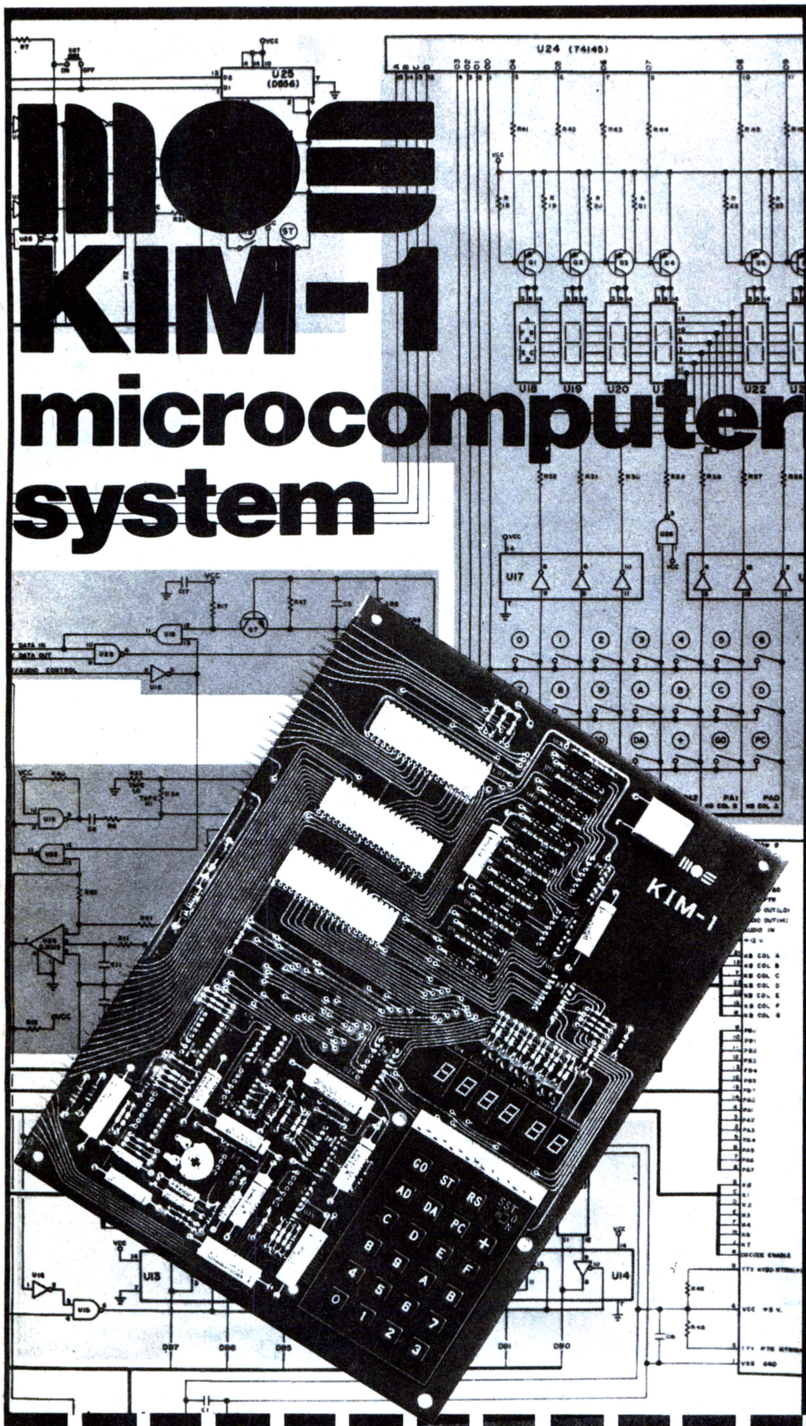

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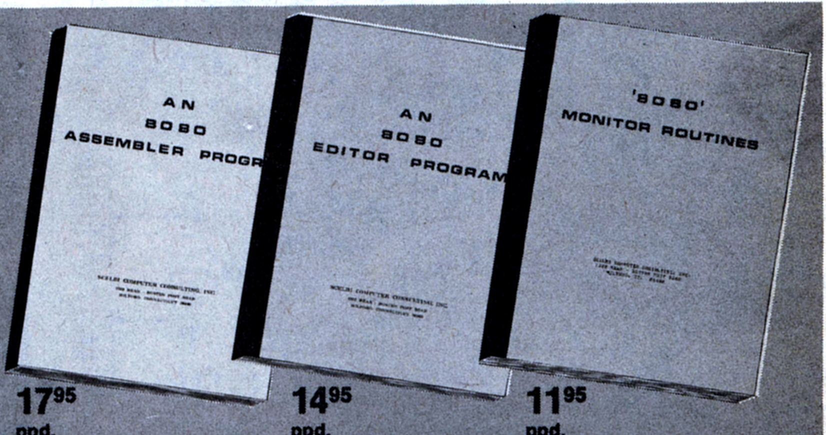

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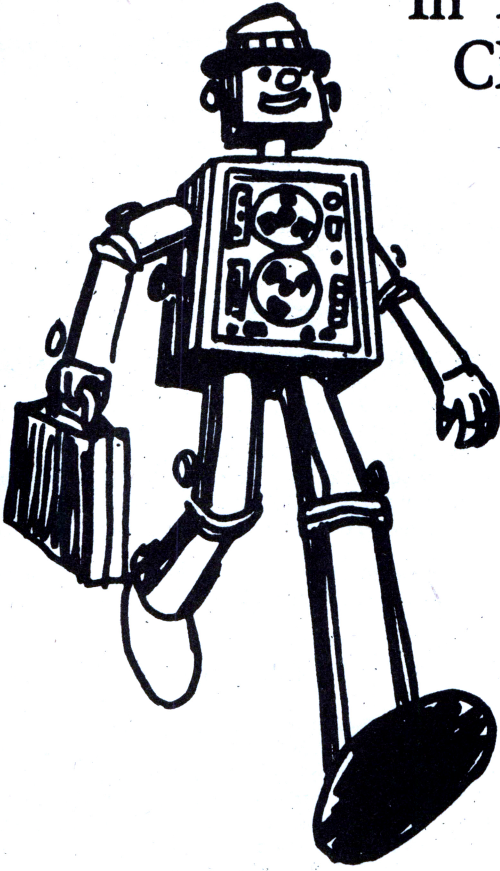

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COVER

The cover art is typical of the many mathematical constructions possible with a small computer plotter. Interestingly, the cover was *not* done with a computer but rather was intricately done by hand lacing strings between carefully drilled holes in a sheet of plexiglass. The artist is Peter Catranides who has many other designs in multiple and limited editions available at very reasonable prices. Write him at 24 Bennett Ave., #34B; New York, NY 10033.

Notices, etc.

CALL FOR PAPERS

National Computer Conference

June 13-16, 1977, Dallas, Texas

Have you just been saying to yourself, "The fastest growing and most exciting area of interest today is the individual and computing. I wish more people were tuned in to its potential and accomplishments."

Now is your chance!! Share your thoughts, dreams, expertise.

As well as the traditional professional areas, in 1977, NCC is looking for papers in the following areas:

The INDIVIDUAL and COMPUTING

- Career Development
- Privacy
- Legislation
- Computer Crime
- Computer Errors Past & Future
- Computers as a Hobby
- Personal Computing
- Computing Satire (Fiction)
- Influence of Computers on Individuals

Deadline: December 1, 1976. For guidelines, contact:
Dr. Robert R. Korfhage, Program Chairman, Dept. of Computer Science, Southern Methodist University, Dallas, TX 75275

ATTENTION READERS

Creative Computing is seeking articles, programs, graphics, games reviews and other material for future issues. We are especially looking for "how-to" material. Contributions should be typed, double-space (3000 words maximum). Include a self-addressed stamped envelope if you want an acknowledgement.

We pay for material from professional writers at rates between 1¢ and 3¢ per word. Please note on your submission whether you are submitting on a paid or unpaid basis (the probability of acceptance is higher for unpaid material). We normally do not pay for material from educators or students.

Upcoming issues will focus on a wide variety of topics including the following:

Computer kits
Arts and humanities
Music
TTY and plotter graphics
Health care, medicine
Psychiatric treatment
Public access (libraries, museums, storefronts)
Retail computer stores
Networks
Computer conferencing
Education
Computer games that learn
Robots and cyborgs
Future computers

OUR FACE IS RED

"Report on Current Equipment" (Mar/Apr 1976, page 29) was, unfortunately, not credited to its author, the very talented and creative Fred Gruenberger of *Popular Computing*, Box 272, Calabasas, CA 91302. Please forgive us Fred.

The puzzles and problems (Mar/Apr 1976, page 67) were credited to *MACUG Newsletter* when, in fact, MACUG had gotten them from *The Point Set*. This bulletin is published by the Department of Mathematics, Univ. of Wisconsin, Stevens Point, WI 54481. Editor is Gordon Miller. Sorry Gordon.

CCUC/8 at Michigan State

The Eighth Annual Conference on Computers in Undergraduate Curricula (CCUC/8) will be held June 19-22, 1977, at Michigan State University.

CCUC is the only national multidisciplinary conference concerned solely with the use of computers in undergraduate instruction. The first conference was held at the University of Iowa in 1970.

For further information and call for papers contact Gerald E. St. Amand, Graduate School of Business Administration, 418 Eppley Center, Michigan State University, East Lansing, MI 48824

Naucal Conference

The National Association of Users of Computer Applications to Learning 1976 Conference Oct. 28-30 in Portland, Oregon will feature *Richard Hooper* talking about Great Britain's national planning for instructional computing, *Seymour Papert* talking about the turtle system for elementary education, *Alfred Bork* discussing computer graphics in education, and *Joseph Weisenbaum* author of *Computer Power and Human Reason*, (reviewed in this issue) speaking on the computer as an extension of the human mind.

To register, write: Dr. John Mandelare, Marion Hall, Marylhurst Campus, Marylhurst, Oregon 97036

PLAY ROOM

Graeme Levin, Publisher of *Games & Puzzles* Magazine, asked me to mention that they are seeking contributions for their monthly "Play Room" feature. "Play Room" consists of relatively short articles about proprietary and traditional games not regularly covered (descriptions, strategies of play, etc.) (Regularly covered games include Mastermind, Chess, Crosswords, Go, and Bridge.) Original card, pencil-and-paper, board, etc. games are welcome.

Send material to "Play Room" Editor, *Games & Puzzles*, 11 Tottenham Court Road, London W1A 4XF, England.

Incidentally, a one-year subscription to *Games & Puzzles* costs $12.00 to the same address. Please mention *Creative*.

WHY REPRINTS?

Occasionally readers write and ask me, why does *Creative Computing* run reprints of articles which have appeared elsewhere and are available through libraries?

1. Many of the publications from which we run reprints are *not* generally available in local or school libraries.

2. I would rather run a good reprint than a mediocre original article.

3. Often I get a reprint of an appropriate article by an outstanding author whereas I could not possibly afford to pay the author for original material.

4. In my experience, if we run a reference to another article, or even a brief synopsis, most people will not bother to look it up (assuming, of course, that it is available). One might argue, "Well, if they don't look it up, they're not interested." I disagree—even interested people won't remember to make note of the reference, or will forget it when they do go to the library. Secondly, I believe that many people who would not normally be interested in a subject, will read about it if it's in front of them, thereby broadening their scope and breadth of knowledge.

This last point explains too why I occasionally let *Creative Computing* take forays into diverse subject areas, sometimes only distantly related to computing.—
DHA

"Tis the mind that makes the body rich."
Shakespeare

DAZZLER SOFTWARE CONTEST

FIRST PRIZE:	$500	certificate for hardware from CROMEMCO
SECOND PRIZE:	$250	certificate for hardware from CROMEMCO

OBJECT:
Develop a program resulting in a new and interesting display using the Cromemco TV Dazzler. (The Dazzler is an interface that permits a home color TV set to be a graphic terminal for certain microcomputers.)

RULES:

- All entries must use the Cromemco Dazzler display and must not require more than 20K of computer memory.
- All entries will be judged on
  1—originality
  2—general user appeal
  3—clarity of documentation
- Entries should include source code and object code on punched paper tape. A listing of an appropriate bootstrap loader should also be provided.
- Software should be compatible with MITS REV 1 serial I/O port convention for I/O requirements (i.e., data transfer is on port 1, bit 7 (active low) of input port 0 is used to indicate receiver ready, and bit 0 (active low) of input port 0 is used to indicate transmitter empty).

Microcomputers can be incredibly versatile. The Dazzler adds the dimension of full-color graphic display to the microcomputer.

What can you develop? — games ? — business ? — education? — art? — others?

SEND ALL ENTRIES TO: PEOPLE'S COMPUTER COMPANY, P.O. Box 310, Menlo Park, Ca. 94025

ENTRIES MUST BE RECEIVED BY SEPT. 30, 1976.

ATTENTION: COMPUTER KIT BUILDERS

Creative Computing is seeking in-depth articles about building various computer kits. We want truthful, straight-forward, in-depth reports covering:

- Ordering, delivery, and manufacturer support
- Ease of assembly, time, clarity of instructions
- Use of the machine, how it works
- Software and documentation

We do not want manufacturer puffery, broad generalizations, or writing bogged down in technical abstractions. We are particularly interested in the Altair 680, IMSAI 8080, SWTP 6800, Jolt System, Sphere, Wave Mate, etc.

Articles should be typed, double space; 3000 words or less. Include photos if possible. Payment will be made at our standard rate of approx. 2½ cents per word. Send material to Editor, Creative Computing, P.O. Box 789-M, Morristown, NJ 07960.

EAI AWARD PROGRAM

Electronics-Associates, Inc., manufacturer and designer of analog/hybrid computer equipment, in order to encourage the use of hybrid technology, has established an award program offering up to

$2500

to graduate students who do research on a topic that is either uniquely dependent on analog/hybrid computers, extends their applicability to technical problems, or improves their utility or performance.

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honoraria are offered to professors who publish on the advantages of teaching both hybrid and digital technology.

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Arthur I. Rubin, Manager, Scientific Computation, Electronic Associates, Inc., 185 Monmouth Parkway, West Long Branch, NJ 07764, (201) 229-1100

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Your Position:

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Number of Kits required: Kit

Number

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If you are a student, please provide the name and school address of your faculty advisor.

Is this an individual project or are other students also involved?

Intel is interested in making available general applications information to all microprocessor users. Do you anticipate producing a final paper (or perhaps a program) that we might make available to other users?

Please return this information to:

Dr. A. J. Nichols, Manager
Microcomputer Applications
Intel Corporation
3065 Bowers Avenue
Santa Clara, CA 95051

Input/Output

Electronic Bulletin Board

Dear Editor:

I enjoy your magazine very much and would like to compliment you and your staff on the fine job that you are doing.

I would like to meet with (or at least talk over the phone with) people in my area who share an interest for computers as I do. Since this magazine is concerned with my interest, I would like to have anyone in my area to contact me if they would also like to rap about anything concerning the EDP. Also, if any of your readers would like to learn of others in their area, I would be glad to offer my services (along with a DEC-10's data base system) to this end. I know that meeting others would be a very worthwhile undertaking, along with the possibility of getting access to sophisticated computer systems. If anyone does contact me, I would be helpful to have at least their name, address, zip, phone number, and possibly experience with computers.

If I can be of assistance to you in any way in the future, please contact me, at (301) 299-4379. (evenings)

Paul L. Yao
8812 Bells Mill Rd.
Potomac, MD 20854

A Dissenting View

Dear Editor:

I'm afraid the review of *The Computerized Society* in your Jan-Feb. issue might cause some people to overlook what I feel is a neat book.

Let's give credit where credit is due. The problem with books of this type is that they are dull. In contrast, Martin and Norman's book is highly readable and downright enjoyable. The quote from Agnew was more indicative of the authors' style and colorfulness than it was of anything else.

Pat Boyd
1461 Hilyard
Eugene, OR 97401

About hardware, games cabbages, kings, etc.

Dear Editor:

I thought the last issue was perhaps the best thought out one I've seen. The program which did geometric proofs was fascinating, really. But I wish you had included the source code, no matter what particular language it was in.

Also liked that "Report on Current Equipment." That was really subtle ... despite all the clues in it, I don't think a single student in my HS would be able to identify what was being discussed. I didn't! As a matter of fact, you nearly had me writing a nasty letter about "Jehovah's Instruments" (I'm a Jehovah's Witness).

But there are a few things I forsee as a problem in CC. I'm not sure what stand you have taken with regard to writing about hardware, but its my guess that you have decided not to get too involved. Which is good, since other mags are already doing a good job, and it is nice to see some variety. So it would seem more logical to me to just completely ignore hardware entirely, rather than write (not you, but your staff) very generalized stuff like, "Microprocessors are very small. They come in ICs. They will get cheaper as time goes on." Anyone who really cares will need a lot more info, and anyone who doesn't care will skip the article. I guess system design does have a lot to do with AI but as time progresses hopefully hardware will become more transparent to the user — he won't have to bother with exact system configs. and other meaningless technicalities.

Another point I wanted to bring up ... I think a lot of hobbyists are getting a little carried away with their Altairs and other home systems. I'm not referring to you, but to other people. One hears a lot of talk about computer revolutions, and computers changing our way of living, and a computer in every home, but if there is going to be a computer in every home, it won't be anything like a black box with lights on it! That is no more useful to Joe American, than say, a flashlight. Less useful. Something which does nothing but eat up around $1,000 and play games and maybe balance a checkbook (now emptied, of course!) will not appeal to many people. Computers will have to show up in ways that they can be easily used by people who know nothing about binary numbers and addresses and compilers. Most people have televisions and radios which can be operated by a 6 year old, and not shortwave sets requiring years of training to operate. Every technological advancement has become popular when it was reduced to a form where the users did not have to become familiar with its working innards ... except the business computer, perhaps. Sounds like good material for an editorial!

Some really strange things going on at the HS here. For a couple of months we had an outbreak of masochism! It is *really* strange to watch a bunch of high school seniors do stuff like pour milkshakes in their pockets ("It was thirsty") or punch themselves out, or dive headlong into a muddy ditch, or throw their watches and glasses down a hall. The masochism has died out and been replaced by total apathy. A lot ot teachers complain that they can't cover the same material with us as they did in previous years.

Please try to avoid making *Creative Computing* too much like Popluar Science by skirting over many "scientific" topics and not going into them in depth. Be sure to live up to the name of your mag. The geometric proof writing program was the most creative program I've seen in a while. I realize that this is probably a very slim possibility, but if you need any paid help with CC for cheap let me know ... I'm looking for a job this summer.*

One other thing. There seems to be some feeling that the quality of the games in *Creative* and *PCC* are too low; one person even said he never got a game out of a magazine he

Three machines. Thousands of uses.

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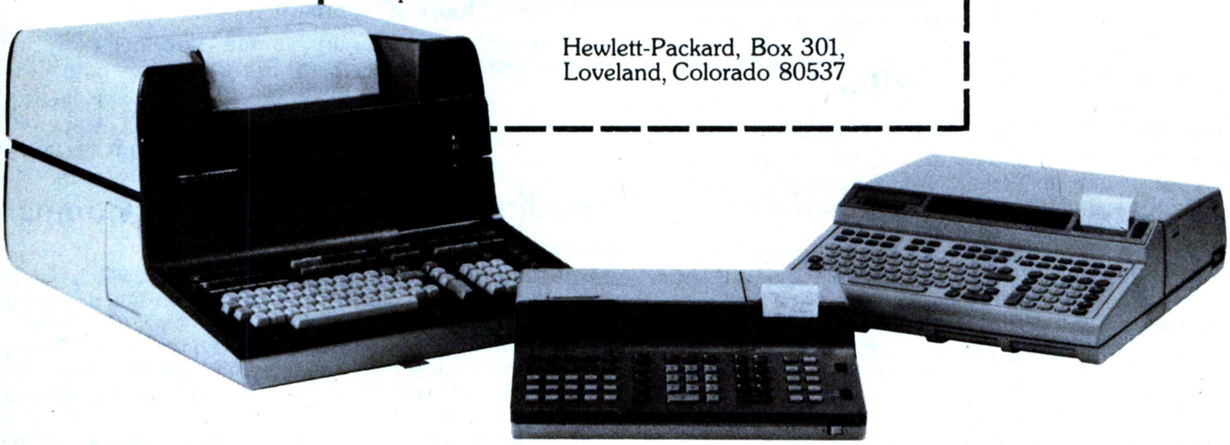

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wanted anyway. I personally subscribe to the school of thought that part of the fun in playing a game is programming it and knowing how it works, and being able to change it. My physics teacher came up with a good rule for determining if a game is worthwhile— "If it doesn't use any unique aspect of the computer — such as its ability to store large amounts of data, manipulate them very fast, randomize numbers, or print things out in a particular way, then the game isn't worth while." Which is what was wrong with MASTERMIND in latest CC ... it could be easily played the normal way. Having the computer play would be interesting as an example of AI.. Similar with Bobstones. Deepspace fit the criterion for a worthwhile game under this rule, however. Just thought you might want to think it over ... it's my guess that you are really not a computer games person, and the types of games appearing in Creative bears this out. Don't take that as an insult, its just a fact. There are more important things than games ... recreation is an end to itself, but not a useful end with respect to other goals.

Believe it or not, the heads took over the computer room here! It is really strange ... all these freaks manage to stop smoking the little green roll-your-owns long enough to play football on a TTY. I would say it was fine with me, except they are really messing things up. Last year, 1 BH (before heads) the computer room was clean and neat, and equipment broke down rarely and was fixed immediately. Now the equipment is always in in partial disrepair and is littered with trash. I guess recreational computing can have its disadvantages.

Yours truly, etc. etc.
Steve North
7 Deerhaven Lane
Newfoundland, N.J. 07435

***Not so slim after all. Steve is working for* **Creative** *this summer (1976) on a variety of things (games, hardware reviews, etc.)*

Attn: Coursewriter Users

Dear Cyberfans:

The Freehold Users' Group is wondering if any of you know of any installation using the "BASIC/Coursewriter" implementation of BASIC. If you know of such an installation or if you yourself use such facilities, please send the name and location of the installation, type of system, your name and address, and your relation to that system (supervisor, student, instructor, passer-by, etc.) To: Anthony Begonja, 31 Brookside Road, Freehold Township, New Jersey 07728

We are interested in communicating with and trading programs with fellow coursewriter users, especially the kind of programs that fully accommodate the various quirks in the coursewriter 1.1 system. This includes the text editor written by the Freehold Users' Group for this kind of implementation and it is available upon request.

Anthony Begonja
For the Freehold Users' Group

Comments on the Turing Test

Dear Editor:

In the Mar/April issue of Creative Computing, Ref.1, Lewis Garrett makes a common mis-statement of the Turing Test as follows: "It consists of a man (the examiner) trying to discern whether or not the responses to questions he has proposed are being answered by a computer or another man."

The actual Turing test, in Turing's own words is given in Ref. 2: "The imitation game is played with three people, a man (A), a woman (B), and an interrogator (C) who may be of either sex. The interrogator stays in a room apart from the other two. The object of the game for the interrogator is to determine which of the other two is the man and which is the woman. ... A's object in the game is to try and cause C to make thewrong identification ... The object of B is to help the interrogator ... We now ask the question 'What will happen when a machine takes the part of A in the game?' Will the interrogator decide wrongly as often when the game is played like this as when the game is played between a man and a woman? These questions replace our original, "Can machines think?"

There are two interesting aspects of this formulation:

1—Turing obviously felt that faking, as far as sexual identification is concerned, requires a high level of intelligence.

2—Turning seemed to feel that the sex of the examiner was unimportant.

An experiment using the Turing game

I have run this experiment half a dozen times in classes at San Jose State University, as reported in Ref. 3. Briefly, a male and a female student are sent out into the hall and the man is told to fool the class into believing he is the woman. The class makes up questions to determine which response comes from the man and which from the woman, using a courier to carry the messages back and forth. The experiment is repeated with the woman trying to fool the class into thinking that she is the man.

It turns out that Turing was indeed correct in surmising that this type of faking requires a high degree of intelligence. However, he failed to realize that the sex of the interrogator is of crucial importance: only a woman can make up good questions to detect a man's faking, and only a man can make up good questions to detect a woman's faking.

By now I know the areas for good questions for detecting both types of faking, and I now know about a certain type of question that can devastate fakers in any field, but I won't spoil the game for you by revealing them at this time. Play the game with some friends and enjoy learning about the nuances of fakery on your own.

Oscar Firschein
Lockheed Palo Alto Research Laboratory
3251 Hanover St.
Palo Alto, CA 94304

References

1—"Primer on Artificial Intelligence," Lewis E. Garrett, **Creative Computing,** Vol. 2, No. 2, Mar.Arpil 1976, pp. 20-24

2—"Creative Machinery and Intelligence," A.M. Turing in "Computers and Thought, edited by Edward Feigenbaum and Julian Feldman, McGraw Hill 1963, pp. 11-35

3—"The Turing Women's Liberation Index," O. Firschein, **DATAMATION,** April 1974, p. 28

"Learning Programs — A Challenge"

Dear Editor:

For some time, I've toyed with the idea of developing a program that "learns." I realize that this has been done by the chess-playing monsters, but how about a simple learning tic-tac-toe program? I have not had the time to work on this much, but the task is a little more difficult than it seems on the surface. I have taken the approach that the tic-tac-toe program "remembers" all previous games. Through some algorithim, it never repeats a losing game. Therefore, eventually only winning (or tie) games are left. I'll admit that this is more "remembering" than learning, but its a crude approach that works. The challenge is in getting the program to fit into a minicomputer *without* a disk. So—if you're interested, I'd like to see what your readers can come up with under these constraints.

1. Tic-Tac-Toe must fit into 32k and not use a mass storage devise.
2. Use any "learning" approach you can dream up.
3. Program must start out ignorant—how long (how many games) does it take before the program wins 10 in a row?

Peter Weiss
COMSAT, Room 4051
950 L'Enfant Plaza S.W.
Washington, DC 20024

Regarding People's Computer Company

Dear Editor:

Upon re-reading the articles on WUMPUS which you have so kindly published I noticed several remarks I made regarding People's Computer Company and its staff. PCC was the birthplace of Wumpus and its first proving ground. The open and creative atmosphere and playful attitude towards computers at PCC allowed the generation of many computer games with truly new ideas.

The creative ferment caused the strong expression of many viewpoints towards ideas. My remarks are meant as views I had towards certain IDEAS and are not meant to be taken personally.

Gregory Yob
Lo-Op Center
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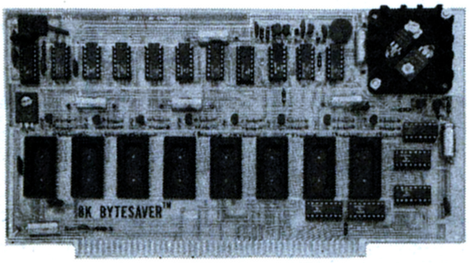

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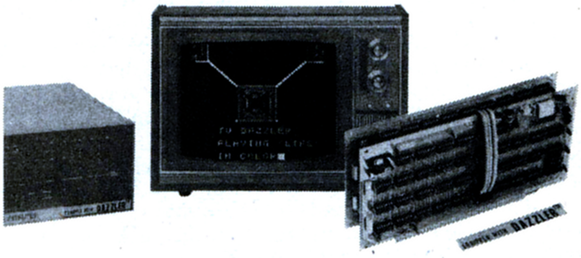

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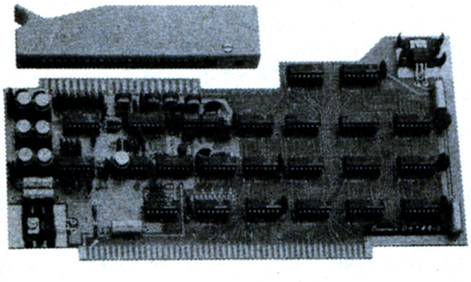

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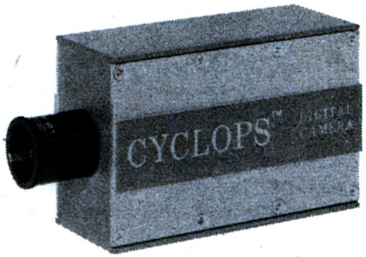

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"Some men make artifacts. To date, artifacts haven't made any men."

April 3, 1976

Dear Editor:

"A bird is an instrument working according to mathematical law . . ."

Which, of course, is manifestly untrue. Birds aren't instruments, they're birds (as da Vinci well knew); the statement shocks, and was meant to shock, precisely because this is so and known to be so. Otherwise one is simply saying that instruments are instruments which if unexceptionable is damn' dull.

We are dealing here with metaphor, the indispensable (if hazardous) tool of all science as it is of all poetry. We are attempting to describe on *aspect* of a real thing ("bird") in terms of something else ("instrument") which it is *not*.

The power and the limits of metaphor, more particularly of its proper subset, analogy, were favorite discussion topics in the Medieval universities. The whole of theology, for example, hangs on this one peg.

Our age hates metaphysic and pays the price: it blunders constantly into logical traps. What da Vinci is saying, I suspect, is this: with respect to those apparent regularities of nature that we like to call "laws", a natural flying creature flies in the same universe as an artificial one.

Whether merely understanding a natural entity infallibly leads to our replicating part of its behaviour with an artificial device I don't know. Airplanes probably had to wait for a most unbirdlike engine and fuel before they could be invented; still, in the meantime a good deal of effort was wasted in the futile attempt to fly *as birds do.* If one excepts the lost work of Prof. Icarus of Greece, it appears that the ornithopter is not cost-effective.

For that matter we still can't fly as birds fly, nor do they fly by our methods. Helium-filled & rotating-wing species are rare birds in Rhode Island, and only in Aristophanes do they propel themselves by ejecting a jet stream from the backside.

I rather think there's a moral to this.

M.1: The analogy between nature and artifact is a useful starting point that is quickly outgrown. Then it becomes a dead weight and generates fallacies.

Computers are not human, which is why they are useful. There are plenty of humans around, after all.

M.2: Statements made about one aspect of a thing become false when the qualifiers are removed.

With reference to electrical shock, I once read that "a human being is a 50,000 ohm 1-watt resistor."

M.3: The claim that some man or some academic discipline possesses real "hard" knowledge undimmed by analogy or metaphor is self-contradictory.

There are at least 4 metaphors involved in making such a claim!

M.4: The curse of our age is the sundering of human culture, and human psychology, into the "two cultures". This fragmentation is greatly accelerated by fallacies like M.3 above.

The result is to oppose one "hemisphere" (to use current mythology, against the other, one man against another, one branch of learning against its badly needed counterpoise.

And so art will lose the love of order, structure, meaning and concrete reality which alone can give it form; and computer programming loses the intuitive, the aesthetic, the all-important criterion of elegance which — to me — is the only justification for programming at all.

I am suggesting, in other words, that motorcycle maintenance and Zazen are alike prerequisites to Satori, to enlightenment.

Digression: I weary of hearing that all programming depends on the ability to flowchart, in approved standard symbols, everything that a program will do.

Respondeo Dicendum Quod (I reply that one must say: "—the standard Medieval prelude to taking a formal position on an issue):

This pretty fable collapses in the face of reality. One never knows what the interaction will be between the actual coding process and one's preconceived notion of structure or flow. I have never written a program or system of programs of any significant complexity without having a good many preconceptions shot to hell. Like electrical circuitry, the diagrams that matter are written after the thing is working — not before.

And this, to me, is the educational value of programming! It is one of the rare places where the young are shaken out of the notion that we so sedulously force down their — alas — trusting throats, that there is an immediate "right answer" to every question; that Teacher knows it, or else has the special edition of the book with bound-in answers (never mind that a substantial fraction of them are wrong!); that wisdom consists in memorizing what Teacher says and imitating what he does.

Well, I've never known a teacher who learned to program with half the ease of an average, if motivated, student.

End Digression.

Parting Thoughts:

1. Another analogy to the processor, suggested by *Travels in Computerland:* the super-duper Lionel electric train set, the biggest and most expensive available toy!

Surely no one believes that adults differ *in kind* from children? Children are as highly sexed as we are, they seek as we do challenge, interests, amusement in their games, and like us again they play sometimes with dangerous toys they cannot control. Or have we adults subjected to Pure Reason the bomb, the Presidency, napalm, "bugs", radioactive waste or the pace and tempo of modern life?

2. Re birds, most of the "birds" man has built were built to kill men; or (a more recent improvement) cities, nations, perhaps the whole planet. As for computers, they are a spinoff from aerospace, the most militarized of all industries. I don't draw any immediate necessary conclusion, but a little sobriety seems called for.

3. Some men make artifacts. To date, artifacts haven't made any men. To explain man by the machine, to explain Henry Ford by the Model T, is preposterous in the ancient sense (backwards). It ignores the orders of causality and of temporal sequence. It is somewhat more natural to proceed the other way, and to explain the work of art or of artifice by studying the artist or the artisan.

4. Must "Creative" stoop to the arguement from scorn? Is it only a fool that thinks human knowledge "mystical" or mysterious, when it is the one thing that human knowledge inself can never quite know?

Our own mind, after all, is not a "thing": it is not something external to us, which we can observe and not contaminate by observation, nor colour by the interposition of self.

Man pondering man is subject to all the self-referential paradoxes of Lord Russell, analyzed rather shrewdly by St. Gregory of Nazianzus some 1600 years before his modest Lordship named them for himself.

So we compromise, as da Vinci did with his bird. We work by analogy, we analyze a part rather than the whole, But ruin awaits us if we drop those qualifiers!

5. One cannot help noticing that hand-in-hand with the reduction of man to mechanics goes a new mysticism of its own, a deification of the machine. Have we come, then, to the worship of the works of our own hands? Has "left-hemisphere" rationality brought us full circle to idolatry?

"Similes illis fiant qui faciunt ea", as another page of your Gutenberg would show. Men who make idols become what they make: sub-humans.

6. Is it too rash to suggest, instead, what your magazine cover carries so splendidly, the first words man set to movable type: In Principio erat Verbum. Before all else there was the Word . . . all things were made through it (or him) and apart from the Word was nothing made. In him was made Life, the light of man: the light shines in the darkness, and the darkness cannot overpower it.

True, maybe; false, maybe; "mystical", certainly. But foolish, surely. And yet is it altogether to be scorned?

7. Remember, in parting, that someone once proved hummingbirds can't possibly fly. This saves one from all sorts of observational error!

8. Two quick thank-yous to your authors:

A. "Information is in no sense truth" (and some of it is downright false). Amen

B. The positive theme of your issue — the future of the computer is unforseeable, but certainly vast — is true & needs saying.

Yours devotedly,
(Rev. Dom) Geoffrey Chase
O.S.B., S.T.L.
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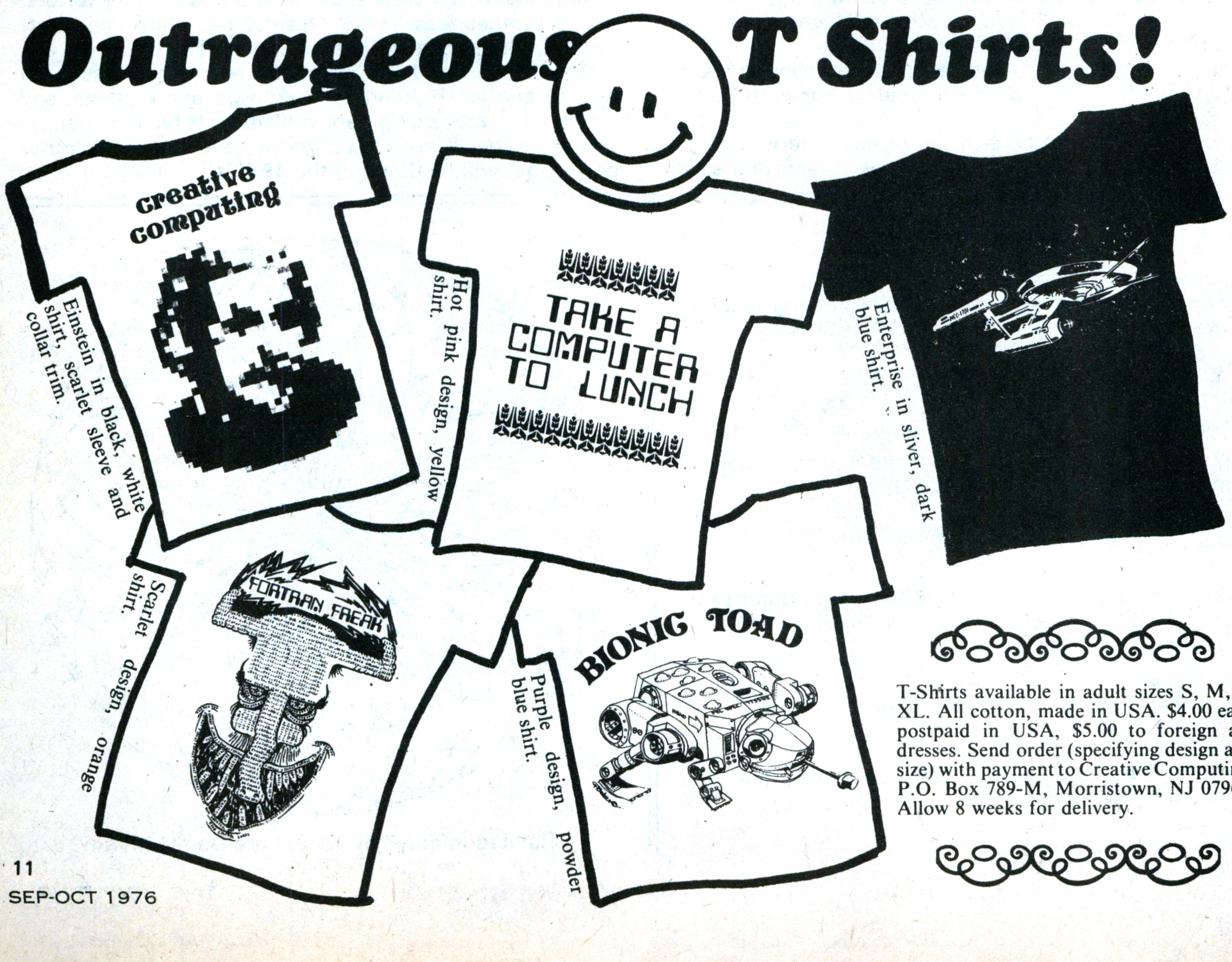

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Instructional Computing In Schools — How, When, What?

by David Ahl

The survey completed by the American Institutes for Research in 1975 projects that every secondary school in the USA will have computer access by 1984 (appropriate date!). But what kind of access? And, more important, will it really be used to advantage?

Personally, I am appalled at what I see in numerous schools that think of themselves as having a computer available for instruction. For example, one local school has an IBM 1130 and one computer science course. In the course, the students "write" (really copy) three canned FORTRAN programs which they then keypunch (Wow!) and give to an operator to run. They get results 3 days later. This is computer education??

I strongly believe that schools should align their education more closely with what will be found in the real world when their students get out. In other words, schools should be at the leading edge of the state of the art instead of lagging it by 10 to 20 years because of *imagined* cost constraints.

What this means in concrete terms is that schools should have one or more timesharing terminals to a powerful large or medium scale system with ability to manipulate very large problems. Secondly, they should have a terminal into an information network such as Lockheed Dialog or the NY Times Data Bank. Third, they should have a variety of mini- and microprocessor systems around for all sorts of things. Indeed for under $1000 a school could build a new MPU kit or two every year! Just think, if the same $5500 per year that the average school spends on *one* timesharing terminal were put toward kits, after 5 years, the school would *own* 25 working computer systems.

The advantage of building a computer kit are many-fold. It's a project that can be done jointly between the vo-tech classes and the math and science classes. Those students who want to get involved with the nitty-gritty of the hardware have an opportunity to do so; students who want to write operating systems, compilers and interpreters can do so; and when the system is finished you have a nice BASIC-speaking computer for everyone to use.

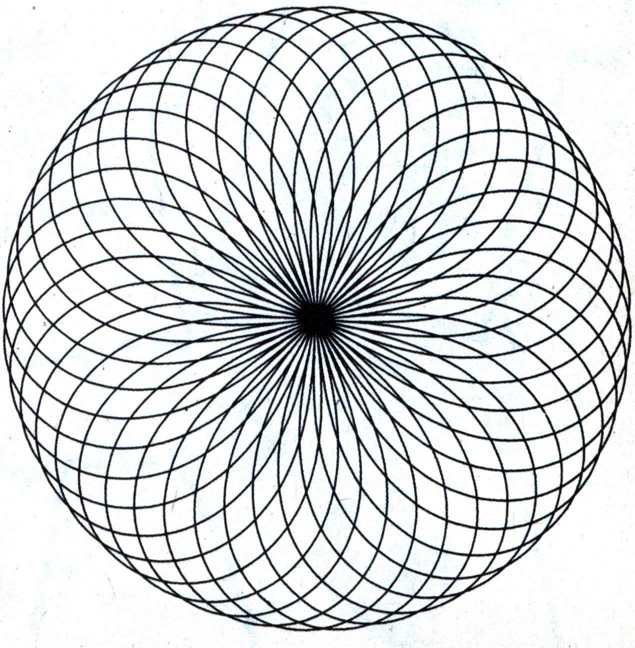
Schools should also attempt to assemble a wide variety of devices and peripherals such as A/D and D/A converters, music synthesizers, audio cassette recorders and interfaces, TV interfaces and character generators, plotters, etc.

Only by having a full range of computer access (both remote and local), hands-on hardware and systems, and variety of related equipment will students begin to get the education they'll need to utilize the tremendous computer power that will be theirs in the 1980's.

An Ideal?

Here's my personal idea of the ideal computer facilities for an average high school in 1976-77 — DHA.

1 hard copy and 1 CRT terminal to comprehensive timesharing system	DEC LA-36 and Hazeltine 1000 to On-Line Systems Timesharing.
1 printing CRT terminal to information network	Dataspeed 40 to Lockheed DIALOG.
1 terminal with animated graphics	General Turtle TT250
1 BASIC Language calculator with plotter or CRT graphics	HP 9830A with printer and plotter or Tektronix 4051
1 mini (kit) with audio cassette, terminal and TV driver	Altair 8800 (8K), ASR 33, Chromemco TV dazzler
1 mini (kit) with A/D, D/A, Music Synthesizer	SWTP 6800, Performer Music Synthesizer



"Rotated Infinity" by Tony (Core Dump) Martin

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BOOKS AND BOOKLETS

A.I. BIBLIOGRAPHY

A comprehensive bibliography listing 334 papers, 7 books, and 29 technical reports produced over the years at the MIT A.I. Laboratory is available. Lists extensive material on LISP, LOGO, PLANNER, robots, etc. Sources of the publications are noted. Ask for A.I. Memo No. 191, updated June 1975.

MIT Artificial Intelligence Laboratory, Room 812, 545 Technology Square, Cambridge, MA 02139

FREE MONEY?

Well, almost free. The 1975-1976 Annual Register of Grant Support is an index to more than 2,500 sources of nonrepayable financial aid from a wide variety of sources. It's 600 pages long and $47.50, so you may need a grant just to buy this book! A similar book, entitled The Directory of Publishing Opportunities, is a guide to publications which accept work from outside sources. The directory is 700 pages and $44.50.

Marquis Academic Media, 200 East Ohio Street, Chicago, Illinois 60611

MICROPROCESSORS IN EDUCATION

This is a bibliography and directory of manufacturers, articles, and other material on microprocessors, microcomputers, and small general-purpose computers. It covers hardware, software, interfacing, etc. Unfortunately, the field is moving so fast that a bibliography becomes quickly dated. Nevertheless, this booklet (dated Feb. 1976) will bring you up to date through 1975.

(I confess to having mixed feelings about this booklet. They list 36 magazines carrying material related to microprocessors in education including ones like *American Laboratory, Iron Age,* and *Machine Design* but do not list *Creative Computing.* One wonders. . . —DHA)

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This group publishes a list of periodicals for "Progressive Scientists" (read "Radical"). Covers a wide range of magazines and newsletters Free.

Progressive Technology, P.O. Box 20049, Tallahasee, Florida 32304

POCKET CALCULATOR BUYER'S GUIDE

A new 32-page brochure, "Pocket calculator Buyer's Guide," is now available free from the Hewlett-Packard Company. The brochure describes and gives specifications for the company's full line of preprogrammed and programmable pocket calculators for science, engineering, business, finance and education from the new HP21 to the original HP65. Guide is free.

Inquiries Manager, Hewlett-Packard Company, 1501 Page Mill Road, Palo Alto, CA 94304

COMPUTER MANPOWER— SUPPLY AND DEMAND

A 39 page booklet by John W. Hamblen. This publication explains what types of jobs are available in data processing and where (geographically) the jobs will be in the future. Also contains extensive statistics on where to get a post-secondary education in computer science. While this isn't exactly the kind of reading you can't put down until you finish, it is something which should be in every high school guidance department. $10 for educational institutions and $25 to everyone else.

Information Systems Consultants, R.R. 1, Box 256A, St. James, MO 65559

BRIEFING ON THE IMPACT OF PRIVACY LEGISLATION

A 65 page booklet published by the Data Processing Management Association. While this booklet is a little heavy, it is definitely worthwhile reading. It consists of commentaries and interviews of people both in and out of government. Some of the 'privacy horror stories' are so shockingly absurd, they're almost funny. (as long as they're not happening to you)! $15.95.

Data Processing Management Association, 505 Busse Highway, Park Ridge, Illinois 60068

new from MATRIX publishers!

FINITE STATE FANTASIES

By Richard Didday

A programmer oriented and directed piece of foolishness designed to produce a chuckle and will no doubt hit some exposed nerves in the process.

Price: $2.25

MICROCOMPUTER DICTIONARY & GUIDE

Charles J. Sippl and David Kidd

This new microcomputer dictionary fills the urgent need for all communications people, computer people, engineers, scientists and industrialists to become quickly familiar with the terminology and nomenclature in a new revolution in computer control capabilities.

Over 8000 definitions and explanations of terms and concepts (704 pages) relating to microprocessors, microcomputers and microcontrollers. There are also separate appendices on: programmable calculators; math and statistics definitions; flowchart symbols and techniques; binary number systems and switching theory; symbol charts and tables; summaries of BASIC FORTRAN and APL. In addition there is a comprehensive electronics/computer abbreviations and acronyms section.

Price: $17.95

ANALYSIS AND DESIGN OF DIGITAL CIRCUITS

Paul M. Chirlian

An excellent text for use in a first course in Digital Circuits and Systems. Provides the Electrical Engineering student with the basic ideas of switching theory and will also provide him with an understanding of the total operation of the complete computer system. The topics of digital electronics and computer interfacing are also considered. In addition, the ideas discussed provide a fundamental understanding of microprocessors and minicomputers.

Price: $16.95

CALCULATOR USER'S GUIDE AND DICTIONARY

By Charles J. Sippl

Contains comprehensive sections on (1) what's available in programmable calculators in today's market — including comparisons (2) how to use most units ranging in price from $50 to $3000 (3) a 7000 term dictionary section relating to calculators.

Programmable calculators are now the keyboard computers for the masses — easily understood and usable by anyone who knows the terminology — students, businessmen, professionals, etc. However, you would be wise to buy a calculator ONLY AFTER READING THIS BOOK! Approx. 550 pages in all.

Price: $9.95

PROGRAMMABLE CALCULATORS

By Charles J. Sippl

Written at an understandable level, this handy reference is designed for anyone interested in calculators. This is a pragmatic "how to use what's available" book on a difficult-to-understand subject. This reference offers a 16 page appendix of glossary terms as well as an appendix of clearly-defined capabilities of products available in the market place. A complete guide to the industry as well as a tutorial book. Available fall of 1976. Approximately 300 pages.

Price: $8.95

MATRIX

MATRIX PUBLISHERS, INC.

Dept. CC, 207 Kenyon Rd., Champaign, IL 61820

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COMPUTERIZED TEACHING IN THE HEALTH SCIENCES

This 200 page book is the most complete and up-to-date collection of information about computerized teaching materials in the health sciences. It contains information on 300 instructional units or programs intended for students of medicine, dentistry, nursing, pharmacy, and other health sciences disciplines. It covers about 750 hours of teaching materials, and includes key-word indexes for subject matter, author, programming language, and source institution. It is published by the Health Sciences Interest Group of ADCIS, and costs $4.50 per copy. Make checks payable to "ADCIS-HSIG."

HSIG Treasurer, 2114 Mason Hill Drive, Alexandria, Virginia 22306.

AFIPS BOOKLETS

Two booklets are available from AFIPS of interest to educators:

"AFIPS Press Publications" lists NCC Proceedings and a wide range of books from AFIPS, the 15 constituent societies, American Elsevier, and Hayden. Free.

"All you ever wanted to know about AFIPS constituent societies (but never could find in one place)" provides exactly what the title says. Free.

American Federation of Information Processing Societies, 210 Summit Ave., Montvale, NJ 07645

HOBBYIST HARDWARE EXCHANGE

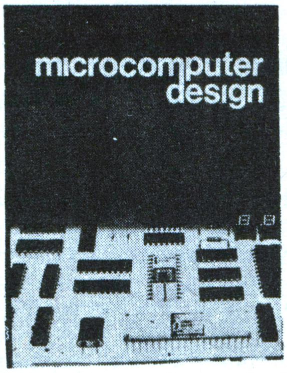
On-Line is a small magazine consisting of nothing but classified ads, both commercial and individual. Mostly ads for hardware hobbyist items, some club listings and meeting schedules. The publisher, D.H. Beetle, guarantees that every issue will carry at least 6 pages of ads, otherwise he'll count it only as a partial issue. Comes out every three weeks. Trial 4-issue subscription $1.00, 1-year (18 issues) $3.75.

On-Line, 24695 Santa Cruz Highway, Los Gatos, CA 95030

AMATEUR COMPUTER SOCIETY NEWSLETTER

The oldest of all the hobbyist newsletters, this one dates from "the good old days" when hobbyists built computers from scrapped 650s, G-15s, and military guidance computers. It now covers kits, chips, and reader experiences. This 6 to 8 page mimeo newsletter appears every 2 to 3 months. Editor is Steve Gray, digital and audio editor of *Popular Electronics* and frequent contributor to *Creative Computing*. $5.00 buys you membership in the Society plus 10 to 12 newsletters over a 2-year period.

Stephen B. Gray, Amateur Computer Society, 260 Noroton Ave., Darien, CT 06820



MICROCOMPUTER DESIGN

A rather technical 400-page book aimed at engineers designing microprocessors into other products. Could also be used as a college text or by advanced hobbyists. Full schematics and circuit descriptions are included for the 8080-based CPU of the MIKE 3 microcomputer from Martin Research. Microcomputer Design book $25.00; literature or the MIKE 3 and Modular Micro Series free.

Martin Research, 3336 Commercial Ave., Northbrook, IL 60062

IC CATALOG

Cybertronics new catalog covers a broad spectrum of ICs and related devices (TTL DIPS, CMOS, Amplifiers, VRs, Microprocessors, etc.). Also sockets, wirewrap stuff, prototyping boards, and capacitors. Catalog free.

Cybertronics, P.O. Box 18065, Louisville, KY 40218

SUPERMARKET SCANNING AND YOU

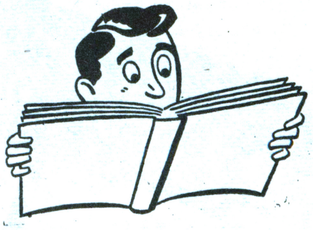
An eight page booklet which explains the advantages of the Universal Price Code—those black and white bars which now appear on almost everything you pick up at the supermarket. As can be expected, this booklet tends to minimize or completely ignore the disadvantages of the UPC. Moderately interesting, though.

NCR Corporation, Main and K Streets, Dayton, Ohio 45479

THE CALCULUS WITH ANALYTIC GEOMETRY TEXTBOOK

This 56 page booklet by Joseph R. Taylor is not intended as a replacement for a standard text, but merely as a supplement to one. However you may find it to be a powerful tool in itself since a wide range of hard-to-remember theorems and problem solving methods are put at your fingertips. Since explanations are short and sometimes a bit abstruse, it would be difficult to try to learn something new from this book. A useful reference, though. Includes index.

Taylor Associates, 59 Middlesex Turnpike, Bedford, MA 01730. Price unknown.



IC, VIDEO GAME KIT CATALOG

Jade Company's new catalog has a complete listing of ICs (TTL, CMOS, Linear) as well as discrete components (transistors, diodes, etc.). [Prices are about as low as I've seen—DHA] Catalog also lists a video game kit ($137.50) that plays 5 interesting games. Catalog free.

Jade Co., P.O. Box 4246, Torrance, CA 90510

MAGAZINES, JOURNALS, NEWSLETTERS

SWTPC 6800 COMPUTER NEWSLETTER

A new newsletter for users of Southwest's M6800 system. The first issue (June 1976) contained the source code for Tiny BASIC on the M6800, and the machine code for Blackjack. The newsletter also told where to get games such as Hangman, Mastermind, and "Klingon Capture" (whatever that is) for the 6800. Printed and mailed free to all M6800 owners and clubs.

Southwest Technical Products, 219 W. Rhapsody, San Antonio, TX 78216

COMPUTE/115

This newsletter is sponsored by National Semiconductor and is produced by COMPUTE (Club of Microprocessor Programmers, Users, and Technical Experts). Since it is so highly oriented toward National and its products (half the newsletter seems to be N.S. spec sheets) it may not be too interesting to people who aren't using National microprocessors. Membership is $15 and also includes listings of user library programs. Printed monthly.

COMPUTE/115 National Semiconductor, 2900 Semiconductor Drive, Santa Clara, CA 95051

SCCS INTERFACE

A newsletter-turned-magazine written by the Southern California Computer Society. Seems to be mostly hardware oriented and largely reprints. To get Interface you must join SCCS—membership is $10/year.

Southern California Computer Society, PO Box 987, South Pasadena, CA 91030

ALTERNATIVE SOURCES OF ENERGY

A.S.E. is a quarterly magazine for people concerned with the development of alternative technologies for a decentralized society. Emphasis is on alternative environmental technologies in the fields of energy sources, agriculture, transportation, and communication. It is written by people who are directly involved with these ideas. A.S.E. also functions as a communications network and maintains a lending library. Besides printing the quarterly, A.S.E. also publishes special booklets on various topics, the most recent of these being *Kilowatt Counter: A Consumer's Guide to Energy Concepts, Quantities, and Uses.* $5 for four issues.

A.S.E. Subscriptions, Route 2, Box 90A, Milaca, MN 56353

NASA FACTS

In contrast to the abounding negative publicity about the space program, this magazine explains some of its positive aspects, and also tells what NASA is involved in now. The June 1975 issue (stock number 033-000-00618-7) has some very timely stuff in it about the Viking Mission to Mars. There are lots of good color pictures and diagrams.

NASA Facts can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, for 50¢.

COMMUNICATIONS TOMORROW

This newsletter is printed by the Special Studies Division of the World Future Society and edited by the talented Wes Thomas. Interesting reading; the first issue (April 1976) had short articles on such topics as satellites for people, fiber optics systems, and computer conferencing. Published bimonthly. Subscriptions as $9 per year.

World Future Society, 4916 Elmo Avenue, Washington, DC 20014

DR. DOBBS JOURNAL

The principle purpose of this xeroxed newsletter is to promote the writing and distribution of free software written for and by amateur computer users—in the form of Tiny BASIC. The first issue contained the entire machine code for Tiny BASIC on an 8080 system and information on how to interface a scientific calculator chip to an 8008. This newsletter recently eliminated "Tiny BASIC" from its name and is now titled *Dr. Dobb's Journal of Computer Calisthenics and Orthodontia.* The intention is to widen out to include other "Tiny" languages. Since many people can't afford all the newsletters out on the market today, DDJCC&O will carry reprints of useful articles from other sources.

People's Computer Company, Box 310, Menlo Park, CA 94025. A year's subscription (10 issues) is $10 and single copies are $1.50

LEARNING AIDS

CARDBOARD COMPUTER

Cardiac, the Cardboard Illustrative Aid to Computation, is a cardboard device developed by Bell Laboratories which can be used to introduce students and adults to fundamental computing principles. Cardiac has 100 words of memory, a single accumulator, and 10 two-address instructions. It can be used to demonstrate loops, indexing, subroutines, double precision, and comes with a 53 page manual. $4.95.

Comspace, 350 Great Neck Rd., Farmingdale, NY 11735

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THE MATH GROUP

This company produces learning aids such as puzzles, posters, and word games. The materials they offer are designed to make learning fun. Free catalog.

The Math Group, Inc., 396 East 79th Street, Minneapolis, MN 55420

LEARNING ACTIVITY PACKAGES

These three learning activity packages were developed by John Gindele, a veteran teacher at Plymouth Junior High School near Minneapolis. They are self-instructional packets designed to introduce 7th grade industrial arts students to the computer

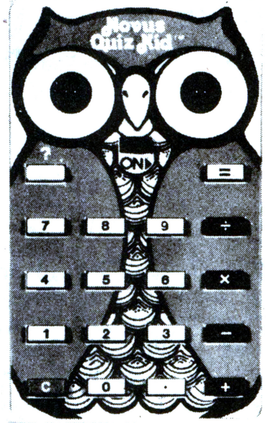
Introduction to Computers — Explains what a computer is and traces the development of computers from before Babbage's "Analytical Engine" to modern day technology. 22 pages.

Introduction to Time-sharing and the BASIC Language—This LAP discusses what timesharing and BASIC are, but doesn't get into any programming concepts. 13 pages.

Using the Computer to Figure the Cost of Your Industrial Arts Project—As Mr. Gindele suggests, this package is a little more limited to use in the industrial arts/mathematics area. While it does explain how to log on, get and run a program, and log off, the packet is oriented towards using a Honeywell 1648 with a TTY and acoustic coupler and is somewhat limited in applications with other systems and terminal types. 18 pages.

These LAP's are $3.50 each or $7.75 for all three and some additional material. Send for a free catalog describing these and other LAPS to EDU-PAC of Minnesota, Box 27101, Dept. 76, Minneapolis, Minn. 55427

(A more complete review of this will appear in the future in *Creative Computing.)*



QUIZ KID CALCULATOR

Here's a new kind of calculator. There's no place for an answer to appear! Instead, a youngster enters a problem such as "9 x 2 = ?" and then punches in the answer s/he believes to be correct. If 18 is entered to the problem above, the owl's green eye will light; any other answer gets a red eye. Watch your kid's eyes light up with this one! It really makes dull arithmetic an enjoyable game at a very economical price. Complete with coloring book chock full of elementary arithmetic puzzles and carrying pouch. $17.95 plus $2.50 shipping.

National Semiconductor Electronics, 1177 Kern Ave., Sunnyvale, CA 94086

GLOBAL FUTURES GAME

A dynamic simulation of present and future world conditions in terms of population, food technology, education, and relative growth rates of each. Groups of players representing eight socio-economic world regions barter for resources in five year rounds ending in the year 2020. Players make collective policy decisions and errors are reflected in "World Destruct Points." Hopefully the players will gain insight into the interconnectedness of world problems and their solution. The game can be played by 8 to 48 high school or college students in two hours. The game is $10 and extra scoresheets are $5 for 48.

Earthrise, Box 120, Annex Station, Providence, RI 02901

MATHIPUTER

A "Mathiputer" is a rugged calculator type device which can be used in classrooms to teach addition, subtraction, multiplication, and division. However, instead of supplying the answer, the student is asked a problem which he must solve. A correct answer will cause a "happy face" to appear, and a "sad face" indicates an incorrect response. Prices range from $199.50 to $324.50 for one which times responses.

Cybernetic Systems, Inc., 9615 Acoma Southeast, Albuquerque, NM 97123

A Creative Computing Equipment Profile . . .

HEWLETT PACKARD 9815A PROGRAMMABLE CALCULATOR

by David Ettel
6015 36th Ave. NE
Seattle, WA 98115

A person unfamiliar with or not interested in how to build his/her own computer system may be interested in a programmable calculator (a what?! — a programmable calculator — you can't hold it in your hand; it can be programmed; it has a few memory registers, a printer, and can be hooked up to many different peripheral devices). Recently I had the pleasure of evaluating (playing) with the brand new, just off the shelf, HP 9815A programmable calculator and immediately fell in love with it (some jealousy has arisen in certain quarters). It is, in the words of my boss, 'darling' — by which I understand her to mean — sleek (13 x 13 inches - 4 inches high) and compact (13 pounds). The 16 character/line thermal printer (numeric, alpha, and a few special characters) and cartridge system, both of which are built in, add to the character of the machine.

The 9815A uses a keyboard language (i.e. commands are entered by using the proper key on the keyboard) which is more effecient (fewer steps are required to do something) than any other programmable calculator I have seen. Some of the commands are:

GO TO
GO SUB / RETURN
FOR NEXT loops
STORE into a register
RECALL from a register
IF statements for conditional branching

24 scientific functions are also included along with the four basic arithmetic keys. Once entered,programs may be edited or stepped through. Editing includes inserting, deleting and changing of instructions. GO TO's and GO SUB's using absolute addresses are automatically updated when inserting or deleting.

The programs are stored in the program memory. The basic machine contains 472 program steps with an option to have that increased to 2008 steps. Storage registers are created by assigning 8 steps of program memory to be a main storage register. Thus memory can be divided between program memory and data register memory depending on the application.

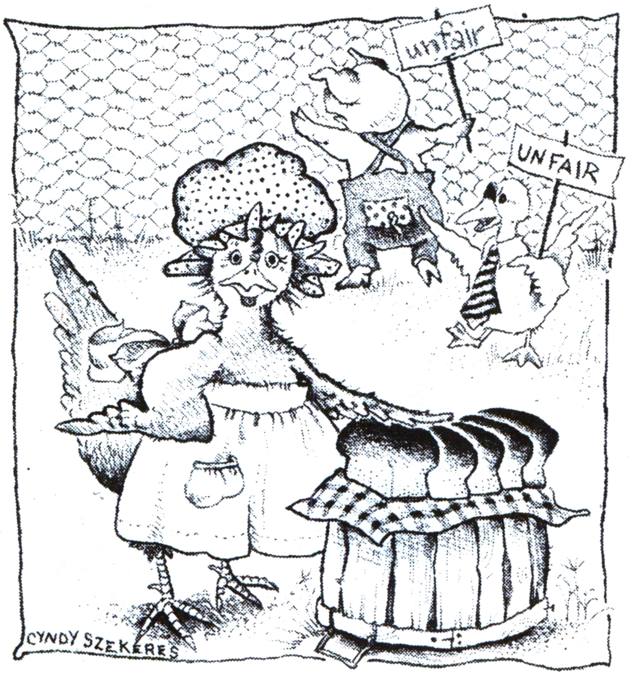
472 steps or even 2008 steps may seem like a serious constraint, but this problem is taken care of by the unique cartridge system. Using cartridges which can hold 96,000 program steps or 12,000 data registers, the effective memory size of the 9815A is enlarged enormously. The cartridge system uses bi-directional search to locate a specified data set. Search speed is 60 inches/second. Read/write speed is 10 inches/second. The compact cartridge contains 140 feet of tape. Two tracks are used for recording information. With the cartridge system programs can be segmented - one program can call another program from the tape and pass control to that program. Called programs can overlay the calling program. Also, data may be stored and recalled from the tape. Program size and data register memory size are therefore not severly limited.

Peripherals include a plotter, a digitizer, paper tape reader, thermal page printer, and paper tape punch. The plotter would be nice for games.

It seems to me that the programmable calculator may be the closest thing to a computer system (core, operating system, software, printer, off-line storage) for a reasonable price - reasonable for the HP 9815A being $2900. I'd be interested in knowing what a comparable do-it-yourself system would cost - then I could make an intelligent decision about what goes on my Christmas list next year.

(More information on the 9815A including brochure and technical data sheets are available from Inquiries Manager, Hewlett Packard, 1501 Page Mill Road, Palo Alto, CA 94304 or from your local HP office.

The Modern Little Red Hen.



Once upon a time, there was a little red hen who scratched about the barnyard until she uncovered some grains of wheat. She called her neighbors and said, "If we plant this wheat, we shall have bread to eat. Who will help me plant it?"

"Not I," said the cow.

"Not I," said the duck.

"Not I," said the pig.

"Not I," said the goose.

"Then I will," said the little red hen. And she did. The wheat grew tall and ripened into golden grain. "Who will help me reap my wheat?" asked the little red hen.

"Not I," said the duck.

"Out of my classification," said the pig.

"I'd lose my seniority," said the cow.

"I'd lose my unemployment compensation," said the goose.

"Then I will," said the little red hen, and she did.

At last it came time to bake the bread. "Who will help me bake the bread?" asked the little red hen.

"That would be overtime for me," said the cow.

"I'd lose my welfare benefits," said the duck.

"I'm a dropout and never learned how," said the pig.

"If I'm to be the only helper, that's discrimination," said the goose.

"Then I will," said the little red hen.

She baked five loaves and held them up for her neighbors to see.

They all wanted some and, in fact, demanded a share. But the little red hen said, "No, I can eat the five loaves myself."

"Excess profits!" cried the cow.

"Capitalist leech!" screamed the duck.

"I demand equal rights!" yelled the goose.

And the pig just grunted. And they painted "unfair" picket signs and marched round and round the little red hen, shouting obscenities.

When the government agent came, he said to the little red hen, "You must not be greedy."

"But I earned the bread," said the little red hen.

"Exactly," said the agent. "That is the wonderful free enterprise system. Anyone in the barnyard can earn as much as he wants. But under our modern government regulations, the productive workers must divide their product with the idle."

And they lived happily ever after, including the little red hen, who smiled and clucked, "I am grateful. I am grateful."

But her neighbors wondered why she never again baked any more bread.

At the conclusion of the required business of the 1975 Pennwalt Annual Meeting, Chairman and President William P. Drake, commenting on the state of the company in today's economy, read this, his own adaptation of a modern version of the well-known fable of The Little Red Hen.

For 125 years we've been making things people need – including profits.

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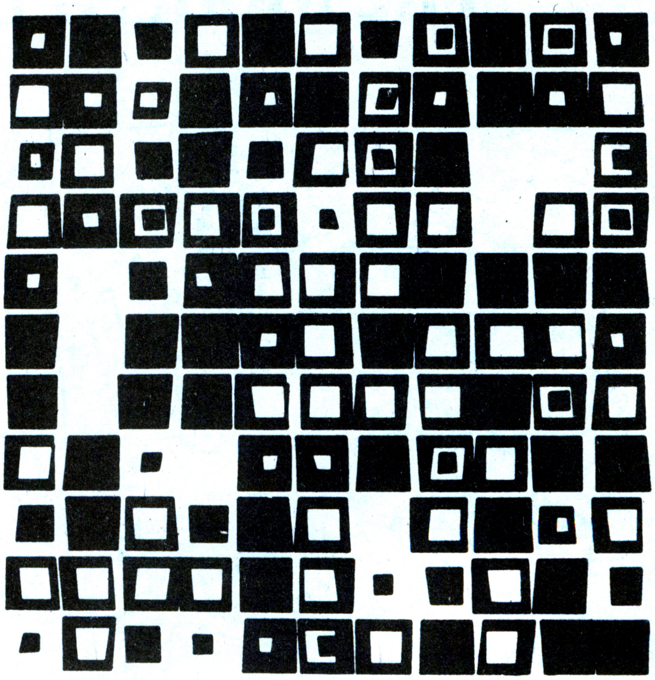
TOWARD THE ELECTRIC SYMBOL

by Robert E. Mueller*
Britton House
Roosevelt, NJ 08555



"Computer Icone" by Vera Molnar

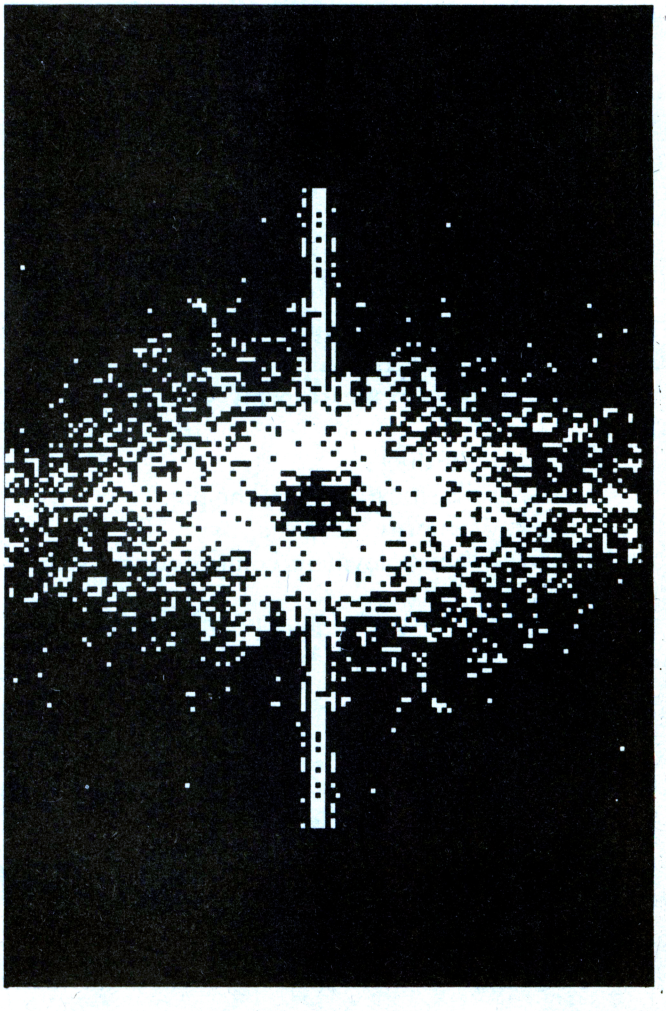
Computer art is conditioning us for a radical new way to think. I call this new process the electric symbol, an entirely new medium for future mathematics and science. But it begins as art. The play instinct of the human mind takes up any novelty and plays around with it for eons before it can take on human meaning. Computer art is at a very early stage of the evolution of the electric symbol.

For example, long before Rene Descartes conceived Analytic Geometry mathematicians played around with geometric patterning that appeared to have little mathematical or scientific significance. The Greek preoccupation with conic sections and infinitely-divisible geometries led to many pre-mathematical insights — calculus was trying to burst out of their thinking, but it had to take many years before it saw the light of day as a strict discipline. Geometers in Descartes time invented many curves for the sake of pure beauty. They even named them: Witches of Agnesi, Devils on Two Sticks, Hippopedes, Cocked Hats, Anallagmatics, Cissoids, Foliums, Horopters, Loxodromes, Pseudoversieras — all names we could easily give to modern computer art. Later all of these curves took on scientific significance in dynamics, magnetism, and electric circuits.

We do not yet understand where our computer art is leading. This is because, I think, we have not yet assimilated the vast array of visual forms made possible with the computer. As art — that is serious visual art like Leonardo's drawings, Rembrandt's etchings, Picasso's abstractions — computer art is little more than elaborate design. [See my article "Idols of Computer Art" in the May 1972 issue of *Art in America* if you want to pursue this suggestion further.] But as a precondition for future mathematics and a new mode of electric symbolization, I think that computer art is extremely important.

Imagine, for example, a future mathematician or scientist bent on mathematical theorization sitting down to a video-computer CRT console with a probe as his pencil. He no longer writes mathematical equations on a two-dimensional surface, using a pencil. Instead he writes *into* a visual space whose geometry can be very complex. His symbolization is not formed out of letters or numbers; out of simple marks such as plus, times, integral signs, or matrices limited by the pencil-and-paper medium. Instead he has the complete electric freedom to invent new multi-dimensional symbols in a deep video space — it can even partake of the entire color spectrum!

Symbolization can proceed in a new way, and computer art forms may ultimately provide keys that will help unlock these new ways to symbolize. The play of computer forms, the designs and beautiful doodles of computer art, take on certain recognizable characteristics. As you look over the art in this book**, try to categorize the art yourself: symmetries within symmetries, sinusoidal variations, planes in movement, multispatial flows, and so on. The future use — the mathematical evolution of a truly novel way to symbolize in this electric medium — will depend upon your conditioning to them. Perhaps you will be able, like Descartes, to call them to mathematical and scientific account, and help give birth to the new electric symbol of the future.



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*Robert Mueller is the author of the book, "The Science of Art," Day, New York, 1967.

**"Artist and Computer" edited by Ruth Leavitt. Available for $4.95 plus 75¢ handling from Creative Computing Press, P.O. Box 789-M, Morristown, NJ 07960.

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By now you've read about the National Computer Conference (June 7-10, New York) in *Computerworld, Datamation, Computer Notes,* and all the rest. But while our reporting is totally untimely, it brims over with poignant human drama and brings you reality as it really was. Keen! —DHA

How We Spent Our Summer Vacation

Following is the story of how four students came to leave the security of the midwest and journeyed to the Big Apple for the National Computer Conference, June 7-10. It is a true story. Any resemblance to fictitious characters is accidental.

-Prelude-

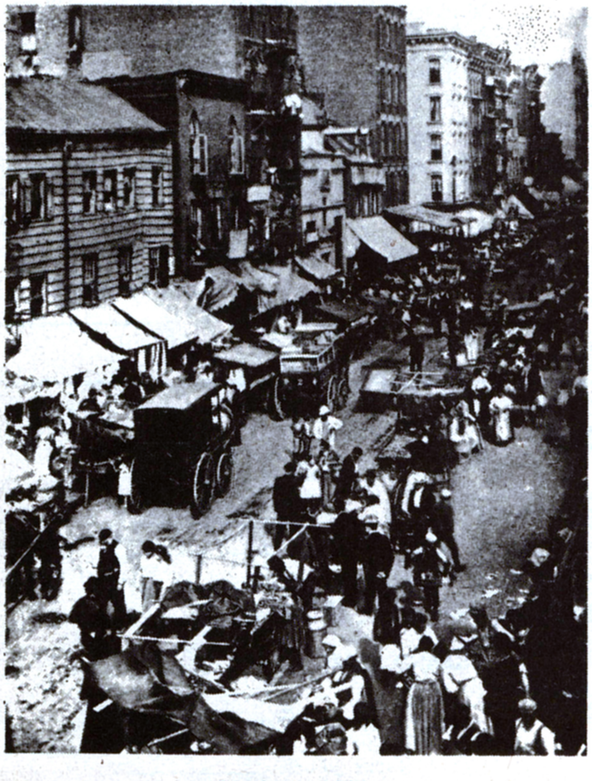
One fine day in January, John was talking on the phone with David Ahl about the magazine and things in general and stuff. In the course of the conversation Dave said, "You're coming to NCC of course?" Caught totally off-guard, John replied, "Uh, NCC?"

"You know. The National Computer Conference in New York, in June? *Creative* will have a booth there."

"Uh, yeh. Uh, I hadn't really thought about it; it does sound interesting. I'll look into it and let you know."

"Okay, If you decide to come you can stay with me and you can even work in the booth. I'd like to meet and talk with you."

The conversation then degenerated into other things but *the crucial idea had been planted.* The subject of NCC was to lie dormant for several weeks until John committed himself by paying the sixty dollar advance registration fee. At that point he became chicken about going all the way to New York by his lonesome, so he took advantage of his position as resident weirdo in the UMR Software Lab to recruit some other people who enjoyed a similar spirit of adventure and lack of common sense. A suitable notice was promptly posted on the bulletin board above the correspondence with Gregory Yob (author of Wumpus and known to refer to the Software Lab as a "zoo") and below the designs for the **S**imple **O**perating **S**ystem.



Big Apple 1899.

Luring people with the promise of an Educational and Enlightening Experience, the chance to meet world-famous DAVID AHL, and above all the opportunity to go to New York *cheap* and miss the first week of summer school, John managed to catch the interest of four undergrads. Time passed. Various means of getting New York were discussed and discarded (the Comp-Sci Department was less than enthusiastic about financing a week long bash for some of its flakyer students). Finally it was decided that the group would travel in Susan's ten year old Chevy. This also pretty well established Susan as one of the group. During this time Dave was asked to extend his original offer of a place to stay to first one, then two, then three additional people. How could he refuse?

The spring semester came to a close with nothing very definite decided beyond the fact that some number of persons would be leaving for NCC on the fourth of June. John and Dave had been exchanging letters completely out of phase with each other, so Dave probably never really knew what to expect. After a short respite in Tulsa, John returned to Rolla late in May, finding under his door a cryptic note on a scrap of brown paper which could only be interpreted as meaning that Sam could not get away from his co-op job long enough to make the trip.

Dave managed to be everywhere but at the other end of the phone for a week, then was finally reached on May 28. One of the out-of-phase letters had included the information that a Tektronix 4051 Graphics System was being loaned to *Creative* for use in the booth, but alas, had no creative-type demonstration programs. It was arranged that the group from Rolla would show up early to write some creative-type demos.

In order to get to Morristown on Friday, June 4, it was decided to leave at five ayem on Thursday, driving the 1200 or so miles in two days. (Not normally any great trick for four students, but only two of these four had driver's licenses.) After two days of trying, John finally reached Dennis, who lives in a one-horse town in northwestern Missouri which evidently still has a wind-up phone system, and told him the departure date.

Like the reasonable, sensible people they are, the group went out for pizza the night before leaving and all got to bed by one ayem except Susan who didn't go to bed at all.

-The Trip-

Susan drove around and collected everyone beginning at fourthirty ayem. We threw our gear in the trunk, buckled our seatbelts and set off in the direction of St. Louis. Sunrise reassured us that we were in fact heading east, so Dennis and Richard fell asleep while John saw to it that Susan stayed awake and kept the car on the road.

Several hours later the group stopped at a grocery store and purchased orange juice and donuts for breakfast, which were consumed at a rest stop several miles further on. Somewhere after breakfast the car began acting funny but it was put down to Dennis not being familiar yet with the car. However, upon restarting the car after gasing up in Terra Haute it sounded like a buzz-bomb, so Susan drove into the first Midas Muffler repair shop she could find.

Fortunately only a gasket was required and the interstate was soon again speeding by at fifty-five. It was decided to shoot for Cambridge, Ohio that day, so reservations were wisely made ahead and Cambridge reached around eight pee em. Dinner was obtained in styrofoam containers at the local McD****d's. The sensible thing to do would have been to go to sleep immediately, but Richard turned out to be a Mary Hartman freak, so John, Dennis and Richard sat up until midnight warching teevee and finishing the orange juice.

Rising at five the next morning the group soon forged into scenic, smog covered Pennsylvania. Tired of the vista offered by I-70, it sounded like a good idea to drive off into the rustic Pennsylvania countryside in search of breakfast.

Forty-five minutes later we heaved a sigh of relief when the good old interstate was found again before the car ran out of gas. Breakfast was obtained in styrofoam containers at you-know-where. The next seventy miles were downhill on the famous Pennsylvania Turnpike. We agreed unanimously that tunnels are neat and that Missouri really should get a few.

The day went on and so did the highway and the trucks and the smog. Bethlehem was picked as a quaint place to get lost in while searching for a place to eat lunch, but this was becoming old-hat and a fast-food emporium was located soon after regaining the good old interstate. Continuing a steady pace for the remainder of the afternoon, Morristown was reached exactly at the beginning of the rush-hour.

Now eastern traffic is a little heavier than that of rural Missouri, so Dennis concentrated mainly on not getting hit by the other insane motorists. Of course it was soon discovered that Morristown was on the *other* side of the interstate, but that was easy to fix and after driving all the way through Morristown and back looking for a shopping center with a phone booth the car came to rest in a school parking lot. Susan had been sitting in the back seat gritting her teeth and pulling her hair at all the things which had almost happened to her car. She now took over from Dennis and Dennis gritted his teeth and made that assortment of noises that only Dennis can make in the back seat.

We were looking for a shopping center with a phone because we wanted to buy some postcards and call David for directions to his house which he said, "You'll never find if I don't tell you how to get there." Since the streets of Morristown appeared to be in the pattern of a mobius pretzel, we were quite prepared to take his advice. So we promptly got lost again and ended up on a road obviously headed out into farmland. Turning around was the clever thing to do, so Susan took the first right and then a few more turns trying to get back to the road we had been on, and succeeding only in getting lost in the suburb we had blundered into, when John suddenly said, "HOLD IT!"

Screech. "Huh, what?"

"That mailbox had 'Ahl' on it."

"Oh, come-on. No way. Putt-putt in reverse.

"A . . H . . L. The right housenumber, too. What street are we on? This can't possibly have happened. The odds don't exist!" But it had happened. We drive 1200 miles and found David Ahl's secluded house by accident. Just programmer's luck.

-NCC and the Big Apple-

We stayed with Dave and Sandy Ahl for two days, occupying ourselves with programming the Tektronix 4051, sleeping and such. Working with the 4051 was a little aggravating because we didn't have a hard copy unit. In spite of that drawback we managed to get some decent graphic demos and games going. The group was accorded great honor by being let into Dave's inner sanctum, where each issue of *Creative Computing* is born. The fabulous "Artist and Computer" issue was just off the press and we also got to see much of the material being pasted up for the Sep/Oct issue.

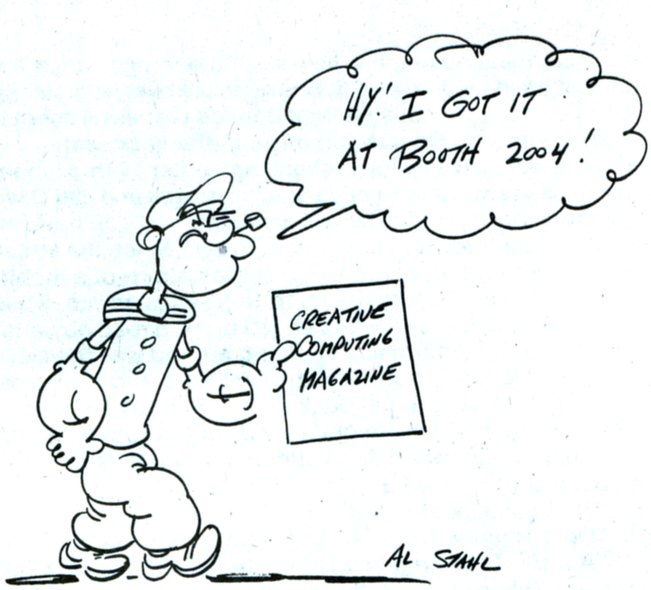
Sunday morning the Tektronix was loaded into the cars along with many (but not enough as it turned out) catalogues, magazines, books, posters and general stuff. Susan, Richard and Dennis then followed Dave and John into New York City. By some strange fluke of luck both cars arrived in front of the Coliseum without mishap. It hardly need be mentioned that the weather, until then fair and sunny, had turned overcast and rainy. This gave rise to a first impression of New York City as something which had condensed out of the smog.

The stuff was carried from the cars in the front of the building and up the escalators to the second floor. This was done during lunch in order to avoid paying union laborers double time to carry it in as all exhibitors were supposed to do. We often bent such rules during the show or we would have been reduced to begging on streetcorners for money to

Susan Culwell, Dennis Keats, and John Lees at the *Creative Computing* booth at NCC during a rare, uncrowded moment.

Typical mob scene at the *Creative Computing/Byte* booth at NCC. Over 10,000 people came by.

Richard Freeman and John Lees peddle *Creative Computing* merchandise in style.



Al Stahl, Popeye animator dropped by our NCC booth and whipped off a quick sketch for us.

leave the place. From the point of view of a small magazine, the costs associated with exhibiting in the Coliseum are atrocious!

The *Creative Computing* booth was on the second floor next to the exit to the escalators to the third floor. Not a bad location at all. During the first two days we shared the booth with the people from *Byte* magazine (another bunch of weirdies). We also handed out information for Computer Mart of New York and we had a Hoboken Computer Works IMSAI 8080 running a TV Dazzler as an additional attention getter to the Tektronix. All in all, the booth looked pretty good. We even had balloons.

After setting up the booth and taking a cursory look at the other exhibits Dave and Richard went off to an exhibitor's party while the other three of us walked to the hotel to our eight floor forty-two dollar a night room with a scenic view of garbage in the streets and heavy particulate matter in the air. It was discovered that the sleeping bags and some books had been left in the car when checking in earlier, so we set off to get them.

The car turned out to be at the very bottom of the parking garage, just above the pump which kept the whole place from flooding. There is very little oxygen at the bottom of a four-level parking garage and the trio was almost happy to regain the eighth floor. We attracted some rather strange looks tramping through the plush hotel lobby, past the bell captain and the dining room and all, dragging a load of camping gear. At least we didn't have to be worried about being mugged for our luggage.

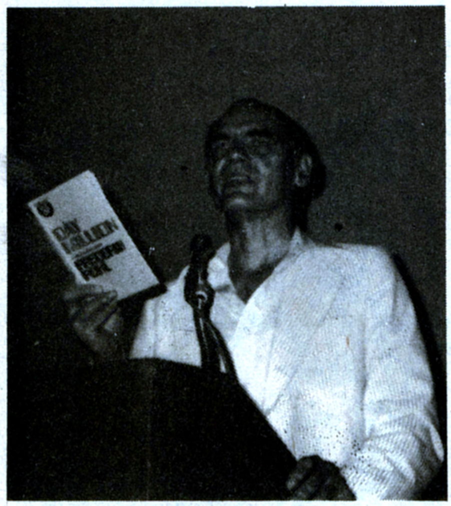
Back in the room the first thought was, "something to drink!" Fortunately there was a soda machine in the hall just outside the door. Unfortunately the machine wanted to be fed 45¢ for each can of soda. Hrrmph. Back home it was 20¢ per *bottle*. Oh, well. When in New York ... The ice machine on the floor didn't work, neither did the one on the seventh floor. The sixth floor had some very wet ice. At least it didn't cost any more.

Luxuriating with the obscenely priced soda pop, the question of dinner began rumbling through our stomachs. The room service menu offered a cheeseburger for $4.20 and coffee at 80¢ a cup. Yipe! Discard the room service menu and forget the hotel restaurant. There was a McD****d's somewhere in the vicinity, but it was now getting dark in the crime capitol and we didn't want to get mugged looking for a Quarter Pounder, so we had some more soda for dinner and wished we had the sense to buy a three pound jar of peanut butter before we left civilization.

Eventually Dave and Richard showed up. They had fared much better in the food and drink department, especially in the drink department. Dave went off to his room and the rest of us discussed New York and listened to Richard's tales of the antics of tipsy exhibitors. Eventually we parceled ourselves out over the room and went to sleep.

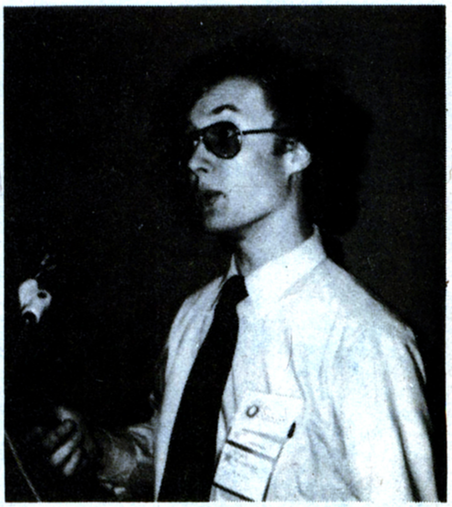
The following two nights Susan slept with Debbie Luhrs of *Byte* at their hotel while Bill Mayhew of Boston Children's Museum slept with us. Bill was also heard to make the comment that we resembled a zoo. This was when Dennis and Richard were using a bed as a trampoline and throwing pillows at each other and Susan and John were writing out loud a letter to Pamelia back in Rolla. To be completely fair about the matter, we feel that Bill still has the potential to be a real weirdo if he'll just let himself go. The fourth night we were all together again in one happy, secure group. Susan was glad to get out of *Byte's* cheap hotel, only twenty dollars a night with no soda machine.

The four days of manning the booth in the Coliseum were, to say the least, tiring and hectic. Each day began with breakfast at the styrofoam emporeum and often ended with dinner at the same establishment. Lunch was 85¢ hotdogs at the Coliseum. Work in the booth consisted primarily of standing in one spot and forcing (politely) people to accept a



Frederik Pohl reads a quote from "Day Million" about computers in the far future—he expects them to provide everything, even sex.

The latest in computer fashions: a magnetic tape gown.



Wild Bill Mayhew of the Children's Museum in Boston describes their extensive computer program for children at an NCC session on Public Access.

copy of our free catalogue. We passed out some 7000 catalogues before the show was over and we ran out early at that. Dave twice had to drive back to Morristown to get more supplies.

The *Creative* booth attracted quite a lot of attention. We were not your usual booth handing out your usual blase sales literature, and most people reacted favorably to that. Dave was even interviewed by the Soviet news agency, Tass as well as the New York Post and others. A number of people from the Tektronix exhibit came over and played the games on our 4051. Evidently their exhibit was too serious for that kind of thing. Interest was even shown in us by IBM. Gee. Of course a lot of kooks stopped by, many of whom said they were subscribers.

We spent some time walking around looking at the exhibits, picking up literature and physically seeing machines we had hitherto only read about. Some of the more interesting things to see were the National Student Computer Fair, the Computer Graphics Art Exhibit, the networking demonstration, the Fourth International Computer Art Festival, the Computer Science Film Theater, and the booths of such well known companies as MITS, General Turtle and Vocal Interface (VOTRAX). In dull moments simply looking at the people always proved interesting. Estimated attendance was 35,000 plus.

One of the more interesting conference sessions we attended was Richard Speer's session on Computer Generated Films. Several really fascinating films were shown, including a mind-blowing one which contained a graphic depiction of mathematically turning a sphere inside-out. Dave hosted a session of Public Access to Computer Power and had a paper published in the Conference Proceedings. As usual some of the sessions, despite interesting titles, proved to be unremittingly dull and we even walked out on a couple.

A highlight of our stay in New York City was the night that Dave took us on the subway to ride the Staten Island Ferry and then to a little restaurant in The Village for a superb dinner. On the ferry we actually got a whiff of decent air and in looking back at Manhatten Island realized just how incredibly filthy the air over New York City really is. The graffiti covered subway trains, although ear-shatteringly noisy, were rather quaint. Getting off the subway at Bleeker Street (memories of Simon & Garfunkle) we walked to Bedford and went through an unmarked door into Chumley's, a restaurant which Dave assured us was one which retained the Bohemian flavor of The Village as it used to be. The meal was excellent although Richard, Demmis and Susan embarrassed Dave by ordering their London Broils well done. John, who grew up in a moderately large city, was cultured enough to order his rare.

Speakers from the NCC Public Access to Computers session joined in Beefsteak Charlie's to have a few. L to R: Robert Smith, Privacy Journal; Ron Anderson, Univ. of MN ("Computer Cartoons," *Creative* 1:3); Trinka Dunnagan, Univ of IA (Technical Transport Problems, *Creative* 1:6); Burchenal Green, Editor of *Creative*.

Thursday, the last day of the exhibit, dragged on. We ran out of catalogues shortly after noon and then just stood around talking to people who came by the booth. As six o'clock approached, Dave went to get the car while the rest of us packed up the booth and carried the stuff down the back stairs, talking our way past guards who wanted to see passes for all the stuff we were removing. John pointed out that it would be silly to write ourselves passes and kept walking as he was talking. Fortunately we didn't have much left at that point and soon we were standing on the sidewalk with a little pile of leftovers when Dave drove up.

We were all greatly relieved to get out of the city and would not have particularly disturbed if New York had sunk beneath the waves as soon as we were through the Lincoln Tunnel. We sped for Morristown, stopping to eat along the way. Following a few hours discussion of the high points of the past five days, such as almost losing all the subscription records when the maid cleaning the room threw them away while we were checking out, we fell into exhausted slumber.

-The Return-

The trek back to Missouri passed without incident of great note. The group took two nights to return since we were all fatigued and even getting a little tired of each other. It is true that there were some interesting points - pizza and donuts in Sharon, the ozone alert covering Pennsylvania, Ohio and Indiana - but they don't amount to much. Suffice it to say that our eleven day trip finally came to an end and we all re-entered the routine of the University.

THE END

Press On

Nothing in the world can take the place of

Persistence

- o Talent will not—
  Nothing is more common than unsuccessful men with talent.
- o Genius will not—
  Unrewarded genius is almost a proverb.
- o Education alone will not—
  The world is full of educated derelicts.

Persistence and determination alone are omnipotent.

From a McDonald's Ad

COMPYOUTER FAIR

Wes Thomas*

Hello - Scott.

"Who's that?"

It's - me.

"Me who?"

I - am - a - Wang - 2200 - computer - interfaced - to - a - Votrax - audio - synthesizer.

I - want - to - show - you - how - I - can - help - kids - learn. . .

"I'm scared. Will it hurt?"

Do - not - be - afraid. - Let's - first - play - a - game.

"Oh, goody, I love games."

I - am - thinking - of - a - number - from - one - to - one - hundred. - Try - to - guess - the - number - and - I - will - tell - you - if - your - guess - is - low - or - high. - You - have - only - six - guesses - until - you - lose. - What - is - your - guess,-please.

"Ah, one hundred and two."

You - are - not - thinking. -Your - guess - is - very - high. -Try - again...

Scott is a dummy. But so what? He was the star of the show. I had wandered in from the exhibits at the New York Coliseum—part of the 1976 National Computer Conference—attracted by a sign that said COMPYOUTER FAIR. And here I was in the middle of the top 58 entries out of 350 submitted by students in the U.S., Canada, and U.S. schools in Europe. And I was talking to Michael Taylor, a 9th grade Lexington, Mass. student-ventriloquist-programmer who had created a "talking computer."

"The program was written in BASIC on the Wang 2200 computer interfaced with the Votrax speech synthesizer," Mike was explaining. "To make the Votrax talk, I used hex codes, which the Votrax understands as the different phonemes (sounds). It puts the phonemes together to form words, so the vocabulary is really unlimited."

"One of the best things it could be used for is education, because it's a teacher that will never give up and its very persistent. It's also good for hospitals. Let's say, for example, someone is sick on the road. The doctor can call the computer at a hospital. The computer will give the person's history, and what medicine should not be given to him, and what should be..."

Michael Taylor, a 9th grader from Lexington, MA poses with his ventriloquist dummy next to his project, a voice synthesis unit connected to a Wang 2200.

I thanked Mike and slipped out of the crowd pressing around me and headed toward a bank of teletype terminals. Seated behind one was Donald Abrams of New York City. He looked like he was about 8 years old, but turned out to be 13. I asked him what he was doing. "This is the Questionnaire Independent Dating System," he came back with, sounding vaguely like the Votrax. I guess he had been hearing it all day. "It is a dating system that does not rely on any one single questionnaire, but can be suited to fit any questionnaire that could be written. It gives you two matches: a general match, which gives each person his or her best match; and an audience match, which matches up every male with one female, and vice versa so there are no conflicts." He paused briefly to allow me to catch up to his thinking. "It also prepares a response summary, which helps you to improve the values of each question by telling you what percentage of the responders to each question matched. Obviously, the lower the percentage of matching, the better the question and therefore it should have the higher priority, since it is in that question that individual differences tend to show up best."

I shook my head in agreement. Obviously. Just what the world needs—a 13 year old combination Ann Landers—computer programmer! Rather than admit I didn't have the foggiest idea of what he was saying, I quickly changed the subject. What else had he been doing with computers? "I've been working in six languages. I intend to modify the system at the school that I go to to make it a bit more like a higher-level computer." What system? "Our IBM 1130. I intend to modify the Disk Monitor System." Sorry I asked.

A CBS-TV crew videotaped Mike Taylor for a spot on the 6 pm news.

Or the Grand Prize winner, Walter Freitag, Jr., of Dresher, Pennsylvania, age 15, who developed a computer perdiction model for the spread of fire. Walter is a self-taught programmer (no computer classes are offered in his school). His father, a chemist, told him his project was impossible, but Walter did it anyway, using the Univac 1108 computer where his father works. The model, written in BASIC, uses a series of three-dimensional matrices to represent the spread of fire in a structure which includes the temperature at which the material ignites, time to "burn out," etc.

Walter believes the model can be developed to be useful for fighting fires and planning new buildings. Walter, who was a previous winner of 5 other science fairs, won an Altair 8800. He thought he might use it to further develop his model, or possibly lend to his school, or both.

William Blum, a hs senior from Huntington, NY demonstrates his digitally controlled electronic music synthesizer to Daniel McCracken, noted author and a Computer Fair judge.

I turned to Andrew Shooman, age 11, absorbed in modifying his own computer or something. A giant drawing over the terminal read "Computer Astronomy Almanac." What was that? "It consists of two programs—a planet program and a moon program." He sounded like Votrax, too. What was this, casting for "The Bionic Boy?" "The planet program gives the position of the planets for any day in

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*Wes Thomas is editor of *Communications Tomorrow*, an occasional publication of the World Future Society; an interviewer for WBAI-FM in New York; a contributor to a variety of other interesting publications; and also toils regularly for Reeves Teletape Corp.

Wes Thomas interviewing Student Computer Fair participants.

1976 and 1977. And the moon program gives the phases of the moon for any date in the 20th century." The TTY was clunking out a series of numbers. "This tells the position of the planets. For instance, this month, Mars is in the Constellation Leo. If you look in the sky tonight, you will see Mars in the Constellation Leo. That makes it easier for astronomers to find." Astronomers that would like some help can contact Andrew at Glen Cove South School in Long Island.

Around the corner, Matthew Korn of Forest Hills, New York was explaining his stock analysis system to two businessmen avidly taking notes. Matthew told me his system throws new light on the stock market and can be seriously used. He would charge "5% of your earnings." Matthew, age 17, is looking for a summer job "at full executive salary, but I'm willing to go down a bit. I'm starting in Yale this September. That should be good for an extra $20,000." Prospective employers can contact his secretary for an interview at Bronx High School. He'll try to fit you in.

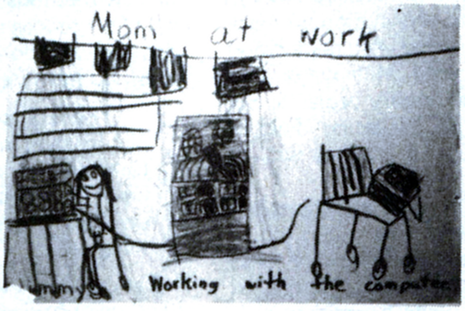
In the next exhibit, Abraham Lederman was playing his advanced monopoly game with a computer terminal, and elsewhere Glenn Sage of Portland, Oregon was toying with a computer game that prepares the player for an imminent stock market crash by buying and selling stock for maximum profit before the crash. These three could be dangerous if they ever got together.

COMPUTER
COMPY
YOU
ER

Leslie Heller, a 6th grader from Poughkeepsie, NY choreographed and performed a ballet based on APL symbols.

Wisely deciding not to make that suggestion, I joined a crowd gathering around a piano, where Stephen Basili, Grade 5 was playing "Computer Boogie," using different musical passages to represent different computer components (". . . the card reader sounds like this. . ."). Maybe Stephen could set IBM documentation to music—maybe that would help. . .

Later, I listened to performances by several other programmer-musicians, including Glenn Poole of Springfield, Virginia, who used "probabilistic mathematical techniques" on a computer to compose music; David Shmoys of Huntington Station, New York, who uses a computer to automatically transform Telemann flute compositions; Bruce Horn, Palo Alto, California, who uses the SMALLTALK language to plot musical notes on a CRT screen, and the New York Chapter/ACM award winner, William Blum, who has developed what may be the world's most advanced analog-digital music synthesizer (more on that in a future issue of *Creative Computing*).



Entry in the poster category at the National Student Computer Fair.

Many, if not most of the fair projects were dreamed up and executed by the students completely on their own, like Alan Sung of Douglaston, New York, who wrote a program to organize Regents' exams, grade the results, and produce statistical analyses, replacing a team of 10 teachers.

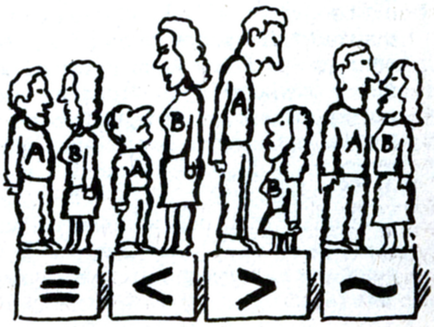
Space doesn't permit a description of the many other exciting exhibits, such as computer pinball, football, and poker games, or BATTLESHIP, or "A Natural Language Problem Solver Employing Modified Deterministic Finite State Automata" (I carefully bypassed that one—I had learned my lesson with Abrams), or Robert Bedichek's homemade minicomputer breadboarded over an entire length of the Coliseum (well, almost), or Lane Molpus (great name, that), who designed his own computer from scratch, or SWARMS (a computer model of attacking bees from South America, no kidding), or the many imaginative stories and drawings—and even a ballet—but *Creative Computing* (where else?) will be carrying more on the fair in future issues.

WORD HUNT
PINBALL
COMPUTER

Three computer fair entries from the Northern NJ Student ACM Chapter.

What was this fair all about? I asked organizer Sema Marks: "We wanted to get away from the computer science fair. This wasn't going to be 'let's just build another compiler.' Computers are for everyone, and computer power is soon going to be in the hands of all the people. One of the interesting questions is how is this computer power going to be used, how can we start thinking about it? These kids regard computers as a free and easy-to-use resource. They are totally intolerant of hard-to-use systems. They are interested in how computers can be fun and how to do things better. We wanted to influence the schools in a very subtle way—to say there's more to computers than FORTRAN programming. We wanted to get the English and Social Studies teachers involved—to encourage students to think about computers, draw pictures about them, write essays, incorporate them into their own way of thinking. I think we succeeded." Well, so did the thousands of enthusiastic people attending the fair. It was the largest, the best organized, and most attractive student computer fair so far. The kids even wrote their own proceedings, published in a giant binder. As Sema modestly told me: "This fair set a new standard."

As I walked out, slightly numbed by it all, Scott was still trying to outguess the talking computer (". . .too low—try again. . ."), Bedichek was adjusting the data rate of his I/O board and trying to tap into the experiment next to him, and Korn, Lederman, and Sage were in a huddle, probably plotting the takeover of IBM. "It's going to be an interesting generation," I thought.



Writers and Computers: An Interview With Carole Spearin McCauley

by Cathy Silverstein
24 Kolbert Drive
Scarsdale, New York 10583

When the words "computer-assisted literature" are mentioned, one doesn't know what to expect. Carole Spearin McCauley is a youthful, soft-spoken Connecticut woman who is one of a handful of authors using the computer to generate prose.

Ms. McCauley was educated as a literature major and subsequently entered professional journalism and creative writing. But after attending various computer and information processing conferences, she sought a way to combine both her job and her interest in technology. She wondered what ways data processing could aid writers involved in literary projects. Six years ago she found what she calls the "gestating" field of computer-assisted literature and through it another way of creating fiction.

Ms. McCauley then began to research various systems but more importantly she sought a "user-friendly" language to use in her programs. She chose APL because of its ability to process both character and numeric strings as well as having considerable editing and formatting capabilities. She learned to program the hard way — by reading inadequate manuals and by experimenting with programs at the terminal. Unfortunately her facility is not equipped to take full advantage of the interactive nature of APL.

"Sex and Violence", her first project, combined both language content and graphics similar to poetry. It involved the generation of phrase substitutes from word lists. The final results were published in an anthology, *Assembling*, edited by Richard Kostelanetz.

Though some may view the preceding as trivial, it must be considered a major advance in the field of computer-assisted prose. As Ms. McCauley states:

> "It (computer prose) must form some kind of whole or people will feel they've been cheated. It either has to be short enough to stand on its own or it must be incorporated into some larger work to help the reader make sense of it.
>
> I don't like to write things that have no purpose. Frankly, things are so damn hard to do, that they deserve a context.
>
> I've found my fiction won't be accepted just because it exists. It must offer someone something in the way of ideas or needs. It doesn't do the cause of computer literature any good to come up with nonsense. I don't want computer literature to get a bad reputation from what I've done."

After "Sex and Violence" she progresses to the stanza form. This project in 1970-71 involved template lines, skeleton format and three categories of mood words (positive, negative and ambivalent). These stanzas were later incorporated into the novel, *Happenthing In Travelon*, she'd begun to write. The novel published in 1975 by Daughters, Inc., a feminist publisher, led Ms. McCauley to what would become the two areas she explores using the computer. Initially she sought another manner of presenting meaningful characters through computer-assisted portraits beyond the usual narrative method ("he said ..... she said .... then they ...."). Secondly she used the computer as a design tool, to add greater dimension to her fiction.

In 1971-72 Ms. McCauley was contacted by Prof. Max Vense and Elisabeth Walther from the University of Stuttgart, Germany. They asked her to write a book, composed of computer-assisted works. *Six Portraits* (1973) was included in a series they published. While working on this book, Ms. McCauley began to realize the first of her goals — the creation of new methods of characterization. This project produced a set of sentences dealing with the protagonists of her developing novel in addition to anagrams of word relations assigned to them. In her words:

> "The computer makes the characters more three-dimensional in a way that is faster and easier than being totally alone in your head. By making connections the writer hadn't seen, it offered an opportunity to meditate on the nature of each character's growth and consistency."

Lest you believe this "miner" has struck a vein of gold, Ms. McCauley has encountered great difficulties when seeking a market for any fiction either totally or partially computer-generated. The hostility shown by many New York publishers has further impressed her with the need for imaginative and well-planned programs. Ms. McCauley thereby plays devil's advocate by constantly evaluating the role of the computer in literature. Can computer fiction stand on its own? Will it make its own statement?*

This author sees the field of computer-assisted literature as a method of extension, much as the car was originally an extension for the horse. She looks forward to a time when a terminal will share equal rights with a television set in the home. In fact, Ms. McCauley believes common use of the computer to be necessary before computer literature will be more widely recognized.

The major drawback Ms. McCauley has encountered is the inability of the computer to adequately express emotion. She anticipates a "change in the traditional goals of programming toward more humanistic and imaginative applications." Finally she feels that greater experimentation with and use of the computer will engender integration of computer science and literature to "help people to remain generalists."

Ms. McCauley sees many areas for expansion and improvement of both form and content in the expanding arsenal of tools employed in computer-assisted fiction. The nature of random composition, literary criticism and generation of the most stringent literary forms such as the sonnet are only a few possible areas. As an author and as a programmer, she yearns for her work to be taken seriously so that the "presence of computer literature in or as a work of fiction will be viewed on equal terms" with both traditional and experimental modes.

Ms. Carole Spearin McCauley and her work show that contrary to often voiced fears, we are not doomed to 'narrow' specialization. In this case, a computer, the once-exclusive brainchild of science, engineering and business, has become an integral part of one of our most humanistic fields, literature.

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*One New York publisher, Praeger, was impressed enough with the manuscript and computer parts of *Happenthing* to give her a contract to do a non-fiction book. This resulted in *Computer and Creativity*, published by Praeger in late 1974.

Once Upon A Computer...

by Carole S. McCauley

The computer as novelist and poet? Vladimir Nabokov Model 360?

As with computer art and graphics, the very idea can disturb or amuse people, including some computer company employees, because it upsets traditional myths about how art or literature are created.

As a writer, I'm a veteran of eight projects in computer prose, totalling hundreds of pages, which I have used in a variety of ways. Besides their literary value, my projects (especially the APL programming!) have tended to teach me what won't work — and why — rather than the joy of celebrating what does work.

Like any other tool or machine, the literary computer may be used oversimply (to produce something that can be done by hand or typewriter) or uncreatively (to produce nonsense or to reproduce something already done). Let me briefly illustrate each of these problems and how they interconnect, since what is simple-minded is probably uncreative, too.

Sometimes these faults can be caused by innocent ignorance because the writer usually is not his/her own programmer, especially at the beginning. S/he must depend on a programming partner willing to work with poetic or otherwise unusual material never seen before. This partner, or the writer after a programming course, must get the data to run through the machine and print out at the terminal without "bugs" (errors).

Another principle is that the machine, while able to make many rapid calculations, is totally dependent on correct data and commands down to every comma and apostrophe. Helpless without them, it has no judgment or ability to proceed independently. The machine can spot an error but not correct it.

1. The literary computer may be used too simply. An example: just feeding it a list of words (*Jesus hotdog freak fruit,* etc.) without syntactical instructions or doing anything further to develop an idea. This means accepting however the machine may churn them out (*fruit freak hotdog Jesus*) for the (possible) humorous results.

The machine also produces handsome design poems, can take a few words or letters and print them in a pretty pattern on nice white paper. So could the poet Guillaume Apollinaire sixty years ago — and so can most people with a typewriter.

2. The machine may be used uncreatively, in my opinion, to produce lines like

O Death . . .
The night
Comes and shines . . .

The river
Winks
And I am ravished.

O night,
Weep like a red flower . . .

O darling,
Dance like a transparent moon . . .
Sink, O darling! . . .

O poet,
The body of your blessing reaches me . . .

Where did these words come from? Their author, who selected such lines from printouts of a computer project at Yale, says, "Typically, 25 words of a vocabulary were taken from an anthology of classical English poetry beginning with the 16th century . . . I took another 25 words from an avant-garde anthology published in the late 1960's." Completing this project was, I know, no small or simple task. It entailed, for instance, 19 different vocabularies of 50 words each, which the machine combined and interchanged by random number generation into "two stanzas a second or a theoretical 7,200 stanzas an hour."

If a writer enters something, s/he gets something out that sounds and looks like poetry. As any lit major knows, however, lines like these have already been done by many romantic poets. The process resembles using a Moog synthesizer to re-produce Beethoven's romantic symphonies.

When an author can avoid the above difficulties, there remain technical and graphics problems. One is getting copy printed dark enough on paper white or good enough to photo offset successfully. Another is getting the machine to repeat itself — to print out two originals that are exactly alike. If the machine process used is random number generation, the essence of randomness is that, like lightning, it is not apt to strike twice in all the same places.

While I enjoy and find my computer experiments fruitful, fascinating, and fun (sometimes lovely copy chugging out and I needn't do a thing — after a certain point), I don't predict a great future community among writers, computers, and computer programmers. Computer time is expensive, few writers are yet their own programmers, and programmers may not possess the kind of minds that want to produce creative literature. Literary experimentation can be an uncertain process, requiring the species of poetic, unprosaic mind that is happy with unfixed parameters, serendipitous juxtapositions, no-definite-end-goal-from-the-beginning. Programmers may find such freedom pointless or frightening.

My eight computerized projects have so far involved a couple experiments with learning computer and programming terminology and applying it to characters in a novel I wrote. Next I did two design poems for which the machine was given two lists of words and two basic sentences, then told to combine and recombine these words, creating nearly endless new sentences, finally commanded to print these on the page in certain designs. The two lists of words: one on sex and one on violence. I achieved the designs by examining the total printout, numbering the "best" sentences (funniest, most sensible, most tragic, etc.), and commanding the machine to print these in certain line lengths.

Line 1: print sentence No. 14 complete, followed by beginning of sentence No. 178. Total width allowable: 50 characters including spaces . . .

Line 5 (shorter line): print characters 1 to 20 . . . The whole is similar to a crochet pattern of varying row lengths and stitches.

The final result begins' SEX

____ and ____ are the end of ____.

SEX.

MARRIAGE and PREGNANCY are the end of LOVE.
LOVE and MARRIAGE are the end of MAN. MAN and
PREGNANCY are the end of WOMAN. WOMAN and
HORMONES are the end of UNDER THE SHEETS.
UNDER THE SHEETS and
DIAPERS are the end of W
OMEN'S LIBERATION. WO

and so on.

Print on the total page is shaped to form the letters S
E
X.

Print on the violence page forms a gun with bullets spraying.

My next project ("Things I Will Never Do Again") resulted from giving the computer over a dozen lists of words (all from my novel, all classified by part of speech and by "value" or tone within the book's emotional context) plus a basic seven-line stanza form:

+ = POSITIVE NOUN, ADJ, VERB, ADV
- = NEGATIVE NOUN, ADJ, VERB, ADV
° = AMBIVALENT NOUN, ADJ, VERB, ADV

RHYME LINE
A +ADJ +NOUN ADV +VERB PREPOSITION THE +NOUN -ADJ AS -NOUN
A °ADJ °NOUN ADV °VERB PREP THE°NOUN
HOW?
+ADV -ADV °ADV

RHYME LINE
MOUNTAIN KNOWS SNOWS
A FABULOUS FIRESHADOW QUICKLY CIRCUITS ABOUT THE GODDESS
DANK AS RAINSTAINS
A FLIRTATIOUS JOETTE SOMETIMES DIAPERS UPON THE PLANE
HOW?
FLATTEREDLY REDCOLDLY KAY-NINELY
SKYFLY

"Things I Will Never Do Again" is actually the last page of the novel, titled *Happenthing in Travel On.* Happenthing is a happening; Travel On is an old house. The book is a winter frontier adventure of a group of women — one with a baby — who take an airplane and live together on a mountainside. More stanzas appear elsewhere in the book, using key words appropriate to the action in each section. Each stanza can also be considered as an interplay of variables (underlined parts of speech, above) with constants (definite and indefinite articles, repetition of certain rhyme lines).

Two more projects, again from the novel, appeared as a separate book, *Six Portraits,* in Germany. These combine design poetry with German-English language learning. The two total about fifty pages of printout. For the first, I assigned to each of the novel's people a symbol plus a paragraph set of basic sentences. Each paragraph is different and appropriate to the personality, speech, and attitudes of the character. Each paragraph appears four times in partial form, the fifth time in complete form. A command (for example, IVY X 5 2 1) begins each computer run on a character. This means that program X will print pattern number 1, 5 times in the first run (first paragraph), double (2) that amount or ten times in the second, and so on until the whole paragraph appears and can be read. Pat. No. 1 has a fixed shape (crosses of horizontal and vertical lines). However, it is again random number generation that determines exactly where, which letters, in each paragraph that pat. No. 1 will choose or use to repeat the design.

Here are samples of a first, third, and fifth (final) run of the paragraph on the character Joette Winton. *Taube* means "dove"; *Schneeballschlacht,* "snowball fight."

```
                                                             HNEEB
                           L                                .  ADD
        I                 RYT
       UNC               T?  I
      S ARE             BED QUI
     ED.
```

```
                                                        N    HNEEB
             E             L                           CAR  .  ADD
        I   RS.           RYT                          VERY
       UNC  ON T         T?  I                       R THE F
   P  S ARE WET.        BED QUI K                                      S
  UNTED.
```

```
                                  E

                    U          ST GE  L           E    IN    HNEEB   SCH   HT.
             E:   AMEB     L  EMATS.  SO         AYI   CAR  .  ADD  HEER  O
  MIL   I   RS.  WE DO    RYT       RSELV       PT THE VERY        ORK.  D
 ERVE  UNC  ON THIS FLIG T?  I     AN UNWE     HER FOR THE F
DIAPERS ARE WET.  GO T  BED QUI K            C     HE DOCT             S  IS
  UNTED.
```

```
    T    N                        E
     D  A:
     PRONOUN    A   U LY:      ST GER L  IM G     E   EIN    HNEEB LLSCHLA HT.
     TRANSLATE:  GAMEBIRD  L  EMATS.  SONGBIRD   AYING CAR  .  ADD CHEER TO
  MILY DINNERS.  WE DO EVERYTHING OURSELVES EXC PT THE VERY   AVY WORK.  DO YOU
 ERVE  UNCH ON THIS FLIG T?  I WAS AN UNWED MOTHER FOR THE F I.  M  SON'S
DIAPERS ARE WET.  GO T  BED QUICKLY--I SHALL C  L THE DOCT  .  THIS    S  IS
HAUNTED.
```

```
JOETTE WINTON      HOUSEWIFE, MOTHER        37
     DATA:  DIE TAUBE
     PRONOUNCE CAREFULLY:  ES IST GERÖLL IM GEWÖLBE.  EINE SCHNEEBALLSCHLACHT.
     TRANSLATE:  GAMEBIRD PLACEMATS.  SONGBIRD PLAYING CARDS.  ADD CHEER TO
FAMILY DINNERS.  WE DO EVERYTHING OURSELVES EXCEPT THE VERY HEAVY WORK.  DO YOU
SERVE LUNCH ON THIS FLIGHT?  I WAS AN UNWED MOTHER FOR THE FBI.  MY SON'S
DIAPERS ARE WET.  GO TO BED QUICKLY--I SHALL CALL THE DOCTOR.  THIS HOUSE IS
HAUNTED.
```

My other German project: I entered into the computer twelve lists of words. That means two equivalent lists (1 in German = 1 in English) for each of the book's six characters. For example, *bang* (German) = "anxious" (English). The machine was then programmed to print these words randomly in anagram-like pairs.

Here is a sampling of words that describe the character Giselle, a frightened student.

```
                                        BOG       S
    A                                   E         C
    R                                   N         A
    D                                   T         B
    O                                        GRIND
    R             C        G
GLUT             FANG    HARM
                  T        I              BANG
                  C        E               N
                  H        F               X
       D             FATAL                 I
       E              W                    O
       S              K       P            U
       T              W       O            S
       I              A       O
       T        ELF   R      ARM
       U        L     D
       T        E               FEE
       E        V               A
    BAR         E               I
                N               R
                   S            Y
                   T
                  FADE                       PEST
                   L                   T     L
 JAMMER            E C                 H     A
   I                PLUMP            DIE     G
   S                 U                       U
   E                 M                       E
   R                 S
   Y                 Y
```

The trick is that to an English-speaking person, the page appears entirely English. However, one-half of each word pair (all the horizontally printed words) is actually German.

Both the German projects are intended as a new kind of verbal portrait, a different method of doing fictional characters beyond the usual "he said, she said, then they . . ." arranged in consecutive paragraphs and pages of narration and description. Both are also satires on foreign language learning in general. Both were done in APL, a general purpose programming language, and the programs appear with them.

My latest project, done for a book *Computers and Creativity,* is a brief, randomized fairy tale. Its title is "Five Ways to Tell a Story: the Sad Case of Catrina M.". Here are two versions of Catrina's first paragraph.

1.

Once upon a time like twenty years ago Catrina M. was born at an early age in Winnemucca, Nevada. She was a smiley baby, full of milk and cereal. At three she attended nursery school where she played with her teachers constantly. Having somehow survived her young years, she entered first grade, full of trust and hope. Her tearful subjects were arithmetic and underwater basketweaving, (This was a very weird school.)

Being a good girl, she married her mother, adored her father, and stammered at her sister, who was twenty years younger. (This was a very major family.) However, she did manage to mature and get it all together by the age of sixteen.

Next she tried female consciousness raising although her father didn't believe in careers for women. This took her thirteen and a half years. When she had finished, she still wasn't qualified to undertake higher education until she learned never to say no.

She never hated anybody because her mother had doubts about success. Comforted by her friends, dog, and boss, she lives a mostly lively life in the Bronx. Sometimes Catrina M. still has doubts about fair treatment but generally she has managed to trust other people.

2.

Once upon a time like a-lady-never-tells-how-old Catrina M. was born at an early age in Caribou, Maine. She was a bratty baby, full of sound and fury. At three she attended nursery school where she ignored her teachers constantly. Having somehow survived her young years, she entered first grade, full of tantrums and eating problems. Her liberal subjects were arithmetic and underwater basketweaving, (This was a very major school.)

Being a good girl, she fought her mother, cried at her father, and married her sister, who was thirteen and a half years younger. (This was a very progressive family.) However, she did manage to flip out and reach outward by the age of ten.

Next she tried female consciousness raising although her father didn't believe in nervous breakdowns for women. This took her twenty years. When she had finished, she still wasn't qualified to undertake diplomas until she learned to brew coffee.

She never blushed at anybody because her mother had doubts about fulfillment. Comforted by her friends, dog, and boss, she lives a mostly celibate life in Milford, Pennsylvania. Sometimes Catrina M. still has doubts about courage but generally she has managed to flip out.

Future possibilities for myself and others in this area: using the machine to explore metaphor and simile with larger vocabularies and other stanza forms, to investigate other rhetorical problems. Why do some of the machine's random choices work so much better than others? Why are some so striking, others nonsense? Can the machine create paradoxes or epigrams? How to compare the process of human, poetic creativity with these electronic processes (random number generation, letter matching, table lookup of equivalents, sorting, merging, etc.)?

Such computer work excites me, at the very least, as a welcome change from the usual think-type-retype-retype process by which literature has been created. The challenge is to devise concepts encompassing, original, complex, and subtle enough to give the machine, the author, and the programmer an optimal workout.

Poets, Birds, Snow, Kites, and The Computer

by Arthur Layzer

Last December, at the engineering institution where I teach, a novel program of computer art works entitled "The Computer Is a Medium" was presented. In these works, the computer in some essential way "filtered" the expression of the English language: the voice speaking the words of a poem was an artificial, musical voice synthesized by the computer (Speech Songs by Charles Dodge); an animated film was constructed entirely out of the textured words of a poem (the author's "Morning Elevator"); the computer was used to spew out possibilities that filled in the blanks of a pre-set sentence structure (Carole McCauley's Do-It-Yourself poems on Sex and Violence); animated graphics and poem fragments interplayed with the aid of a general programming language (Stan Vanderbeek's and Ken Knowlton's "Poem Fields").

At the center of "A Computer Is a Medium" was a non-computer event, a reading by Siv Cedering Fox. Her poetry evoked personal resonances from inorganic snow, ice and water. A remarkable illusion of spatial extension occurred, enhanced by a computer-music background of James Randall.

At first sight it seems absurd to have invited a live poet to a computer arts program, about as absurd as entering a bird in an exhibition of fancy kites. The situation looks more reasonable if you compare not how well the computer-kite or the bird-poet can fly but how they each take to the wind. The bird-poet flies effortlessly. The computer-kite with its over-simplified angular construction is vulnerable and reacts transparently to the wind blowing. And it is dependent on a human hand for guidance by way of a long string that is just visible enough so that you can't forget it.

What is the wind for the artist who works with the computer? That is the hardest thing and sometimes you have to blow *yourself* to keep the composition afloat. But there is also the wind of random numbers and the wind of a programmed process which you have set up but which you can't control from moment to moment.

It seems that only by getting outside of ourselves can we express anything that is profound. The poet learns this instinctively and is then called crazy.

The inside of the computer is chilling in its starkness, its ordered qualities and its fragmentation. When the creative wind blows on the computer's personality, shapes it or melts it to an organic form that we recognize as humanly associated—takes the computer's personality outside of itself—we feel the significance of the human situation in a striking way: We have managed to get outside of ourselves also—perhaps going the other way.

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Producing Computer Poetry

by Margaret Chisman
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Ideas mill around vaguely for some time. I collect words that appeal to me visually, orally or semantically without any special theme in mind. This phase corresponds to the 'data soup' of scientific problem solving and can last for months. Sometimes the fermenting process erupts under its own volition, or under the jerk of an outside impetus — such as the Computer Arts Society writing to me about a forthcoming exhibition at the Science Museum, London, of computer generated art.

I produce, as a first step, a verse, which is generally the kind of apparently meaningful nonsense that Chomsky refers to about green ideas sleeping furiously. I use for the parts of speech I desire whatever words in that category first come into my head — this is to get the lilt or rhythm of the verse. For example: —

Should fancy free us from technique
Or belief lead us to provocative faith
Should loving add to our pattern of crime
When all living is dead.

or another

My heart looks at life
Thrusting with growth but true
Always giving never having
Agony though softened corrupts.

I then break it down as follows: — (taking the second verse)

	My	*(Fixed)*
(1)	heart	*noun singular subject*
(2)	looks at	*verb present tense singular*
(3)	life	*noun singular object*
(4)	Thrusting with	*verb present participle*
(5)	growth	*noun singular*
(6)	but	*linking word*
(7)	true	*adjective*
(8)	Always	*linking word*
(9)	giving	*verb present participle*
(10)	never	*linking word*
(11)	having	*verb present participle*
(12)	Agony	*noun singular*
(13)	though	*linking word*
(14)	softened	*verb past participle*
(15)	corrupts	*verb present singular*

Then in each group I list say 8-10 words (limiting myself to about 10 because of the time factor — finding 10 words that please me, in each group can take up to a week.) I use Rodale's 'Synonym Finder' and also his 'Word Finder' plus Chambers Twentieth Century Etymological Dictionary. I do not make any attempt at rhyming as, in my experience, this would not only make my work immeasurably more difficult but amateurish rhyming can be bathotic. However there is place for it in humorous verse.

The criterion for the selection of words in each group is generally overall compatibility of meaning, mood and category but with an occasional word quite out of keeping to provide a jolt. Each person has their own repertoire of words, and writing this kind of poetry it is easy to get into a semantic rut. So I flip the dictionary open randomly and follow up any interesting words in the Synonym Finder.

In the early days of my work I used a Telcomp programme with a random number generator to select from each group. I eventually decided this had less than an artistic result in that words could, and were used over and over again, thus reducing the impact. Quite by chance, I made an improvement. One day I could not get on a terminal and so, impatiently, I wrote the words on pieces of card and put each group of words in a separate bag, taking one word out of each bag in order. It struck me then that it would be better poetry if, after taking a word out I did not put it back again (as the computer does in its random number generator). Thus I had x number of verses corresponding to x number of words I put in each group and there was no repetition. Other sets of verses can, of course, be produced, by putting the whole lot of the words back again in the bags and starting all over again.

I believe several other computer poets have discovered they can simulate the action of a computer thus. The contribution of the computer (or a 'computer approach') is to suspend judgment on conventional patterns of association.

I deliberately never use punctuation in computer poetry because its absence allows greater varieties of combination of meaningful groups of words.

Groups of words used for verses that follow

Slot 1	Head, eye, hand, reason, heart, child, flesh, mood.
Slot 2	Thrives on, quickens with, delights in, shades into, leads to, craves for, yearns for, prepares for.
Slot 3	Pain, grief, rejection, enchantment, caresses, life, joy, prayer.
Slot 4	Unseen by, bleak with, eager for, strong with, free from, fresh to, ardent with, blind to.
Slot 5	Guilt, doubt, despair, sin, pride, lust, dread, lies.
Slot 6	Maybe, yet, even, but, now, never, perhaps, always.
Slot 7	Vague, true, calm, dull, soft, cruel, fierce, vain.
Slot 8	Not, rarely, beyond, above, sometimes, seldom, just, only.
Slot 9	Relaxing, hoarding, quarrelling, blaming, probing, seeking, hiding, drifting.
Slot 10	Repeat slot 8
Slot 11	Seducing, aching, dreaming, doubting, pitying, loving, daring, stifling.
Slot 12	Comfort, sorrow, friendship, freedom, passion, praise, remorse, truth.
Slot 13	Started with 'though' and changed to 'if' as it was more meaningful..
Slot 14	Controlled, withheld, followed, enforced, enjoyed, derided, applauded, suppressed.
Slot 15	Corrupts, consoles, refreshes, enslaves, endures, destroys, divides, consumes.

MYSELF MANIFEST

Margaret Chisman, 1974

1st Selection

My head thrives on pain
Unseen by guilt
Not relaxing not seducing
Comfort if controlled
Corrupts

My eye quickens with grief
Bleak with doubt yet true
Rarely hoarding rarely aching
Sorrow if withheld
Consoles

My hand delights in rejection
Eager for despair ever calm
Beyond quarrelling beyond dreaming
Friendship if followed
Refreshes

My reason shades into enchantment
Strong with sin but dull
Above blaming above doubting
Freedom if enforced
Enslaves

My heart leads to caresses
Free from pride now soft
Sometimes probing sometimes pitying
Passion if enjoyed
Endures

My child craves for life
Fresh to lust never cruel
Seldom seeking seldom loving
Praise if derided
Destroys

My flesh yearns for joy
Ardent with dread perhaps fierce
Just hiding just daring
Remorse if applauded
Divides

My mood prepares for prayer
Blind to lies always vain
Only drifting only stifling
Truth if suppressed
Consumes

2nd Selection

My flesh leads to rejection
Free from despair never soft
Beyond hiding beyond dreaming
Remorse if applauded
Divides

My child thrives on grief
Ardent with pride yet true
Just seeking just dreaming
Truth if controlled
Corrupts

My heart quickens with enchantment
Eager for dread now fierce
Rarely blaming rarely seducing
Comfort if withheld
Enslaves

My hand shades into life
Unseen by sin always vague
Sometimes releasing sometimes stifling
Freedom if enjoyed
Refreshes

My reason delights in caresses
Bleak with lies maybe cruel
Not quarrelling not doubting
Friendship if derided
Consoles

My eye prepares for pain
Fresh to lust but vain
Above probing above loving
Praise if followed
Endures

My head craves for joy
Blind to guilt perhaps calm
Seldom hoarding seldom aching
Passion if enforced
Destroys

My mood yearns for prayer
Strong with doubt ever dull
Only drifting only pitying
Sorrow if suppressed
Consumes

HAIKU GENERATOR

Paul J. Emmerich
Dana College, Blair, Nebraska

This program is a rather trivial example of the symbiotic relationship of man and computer forecast by John Kemeny as the direction of future development. In it the operator interacts with the computer to produce seventeen syllable, three line statements which, with luck and perseverance, may be termed haiku. You'll no doubt remember that a haiku is a Japanese form of poetry that consists of three lines containing five, seven, and five syllables. The main idea is to present a striking image.

Program Characteristics

The program is composed of four lists of words (nouns, verbs, adjectives, and adverbs), one punctuation mark (the ellipsis), and a method of selecting words at random from these lists to be combined in a particular pattern. The pattern of word categories is determined by the operator at the time he runs the program.

Two inputs are required from the operator — a limit for choosing a number of random numbers (referred to by the program as a "seed") and the pattern of words to be used in composing the haiku. The "seed" is used to run through a series of random numbers produced by the computer's random number generator. The random numbers determine which particular words are chosen from the word lists in the pattern specified by the operator. The word categories are entered as numbers — 1 for noun, 2 for verb, 3 for adjective, 4 for adverb, and 5 for an ellipsis. Up to eighteen categories can be entered for this pattern.

Syllables are counted by identifying *a, e, i, o, u,* and terminal *y*. Terminal *e* does not count as a syllable. Thus *boot* would count as two syllables and *the* would not count at all.

The lists need not be single words since the strings are combined on the basis of length regardless of internal blanks. By following the spelling conventions described above, you can modify the lists to include anything that you desire. If you do not follow the rules (e.g. you use words with adjacent vowel letters that are not pronounced separately), the worst that will happen is that the machine will not count syllables correctly.

Lexical items must be 26 or fewer characters, thus permitting phrases and clauses as well as individual words in the lexicon of the program. Since a haiku contains only seventeen syllables, the number of word categories never needs to be longer than that. In fact, one or two categories can be used alone since the program repeats the input pattern as many times as necessary to come up with at least seventeen syllables. Each haiku is also limited to a maximum of 255 characters.

Currently, there are eighteen of each — noun, verb, adjective, and adverb. From these 72 entries and the one punctuation mark permitted, there are thousands of different combinations possible. Changing the vocabulary, of course, increases the number of different haiku that can be written by the program. If your form of BASIC allows character strings in DATA statements, you can work out a nicer lexicon by using the RND function and reading from DATA statements.

Operation

Type the word RUN, followed as usual by RETURN. The program will respond SEED? Enter a number. When the program has produced that many random numbers, it will ask for your list of word categories. Enter numbers from 1 to 5, pressing RETURN after each. The numbers mean:

1 choose a noun
2 choose a verb
3 choose an adjective
4 choose an adverb
5 put in an ellipsis.

At the end of your pattern, enter 0 (zero) to tell the machine to start composing the haiku.

If the first part of a haiku is satisfying, modifications can be made by choosing the same seed, repeating the word category pattern as far as it is satisfactory, and then changing the remaining entries in the pattern.

The program and a sample run appear below.

Author Emmerich and Nova computer produce Haiku together.

"HAIKU" LISTING

```
LIST
0010 REM *****HAIKU GENERATØR
0020 REM *****D.C. PRØGRAM LIBRARY FILE NØ. 850-1
0030 REM *****WRITTEN BY PAUL J. EMMERICH, FALL, 1973
0040 REM *****DANA CØLLEGE, BLAIR, NEBRASKA 68008
0050 DIM C[18],P$[255],A$[26]
0060 PRINT "SEED";
0070 INPUT N
0080 PRINT
0090 REM        *****WIND RANDØM NUMBER GENERATØR
0100 FØR I=1 TØ N
0110   LET X=RND(1)
0120 NEXT I
0130 LET C1=1
0140 REM        *****PATTERN INPUT RØUTINE
0150 PRINT "WØRD CATEGØRIES"
0160 INPUT C[C1]
0170 IF C[C1]=0 GØTØ  0210
0180 IF C[C1]>5 GØTØ  0130
0190 LET C1=C1+1
0200 GØTØ 0160
0210 LET I=0
0220 LET C1=C1-1
0230 PRINT
0240 REM        *****CØNSTRUCT STRING
0250 FØR J=1 TØ C1
0260   LET A=INT(RND(J)*100)+1
0270   IF A=0 GØTØ  0260
0280   IF A>18 GØTØ 0260
0290   ØN C[J] GØSUB  0670, 1100, 1510, 1920, 2330
0300   LET P$=P$,A$
0310   LET I=I+1
0320   IF I=17 GØTØ 0360
0330 NEXT J
0340 LET J=1
0350 GØTØ 0250
0360 LET J=1
0370 REM        *****BLANK REMAINDER ØF LINE FØR PRINTING
0380 LET P$[LEN(P$)+1,250]=" "
0390 LET S2=5
0400 LET L=L+1
0410 REM       *****CØUNT SYLLABLES
0420 FØR I=J TØ LEN(P$)
0430   IF P$[I,I]="A" GØTØ  0500
0440   IF P$[I,I]="E" GØTØ  0490
0450   IF P$[I,I]="I" GØTØ  0500
0460   IF P$[I,I]="Ø" GØTØ  0500
0470   IF P$[I,I]="Y" GØTØ  0520
0480   IF P$[I,I]<>"U" GØTØ 0540
0490   IF P$[I+1,I+1]=" " GØTØ  0540
0500   LET S1=S1+1
0510   GØTØ 0530
0520   IF P$[I+1,I+1]=" " GØTØ  0500
0530   IF S1=S2 GØTØ  0570
0540 NEXT I
0550 REM        *****END ØF WØRD?
0560 LET I=I+1
0570 IF P$[I,I]<>" " GØTØ 0560
0580 REM        *****PRINT LINE
0590 PRINT P$[J,I]
0600 LET J=I
0610 LET S1=0
0620 IF L=2 GØTØ  0390
0630 LET S2=7
0640 IF L=1 GØTØ  0400
0650 PRINT
0660 STØP
0670 REM        *****NØUN RØUTINE
0680 IF A>9 GØTØ  0700
0690 ØN A GØTØ  0720, 0760, 0800, 0840, 0880, 0920, 0960, 1000, 1040
0700 LET A=A-9
0710 ØN A GØTØ  0740, 0780, 0820, 0860, 0900, 0940, 0980, 1020, 1060
0720 LET A$="FLØWER "
0730 RETURN
0740 LET A$="WINDØW "
0750 RETURN
0760 LET A$="BIRD "
0770 RETURN
       .
       .
       .
```

Insert 16 additional nouns of your choice here in Statements 800 - 1060. Each noun needs a LET A$ = "word" and a RETURN.

```
1100 REM        *****VERB RØUTINE
1110 IF A>9 GØTØ  1130
1120 ØN A GØTØ  1150, 1190, 1230, 1270, 1310, 1350, 1390, 1430, 1470
1130 LET A=A-9
1140 ØN A GØTØ  1170, 1210, 1250, 1290, 1330, 1370, 1410, 1450, 1490
1150 LET A$="RUN "
1160 RETURN
1170 LET A$="SHINE "
1180 RETURN
1190 LET A$="SING "
1200 RETURN
       .
       .
       .
```

Insert 15 more verbs here

```
1510 REM        *****ADJECTIVE RØUTINE
1520 IF A>9 GØTØ  1540
1530 ØN A GØTØ  1560, 1600, 1640, 1680, 1720, 1760, 1800, 1840, 1880
1540 LET A=A-9
1550 ØN A GØTØ  1580, 1620, 1660, 1700, 1740, 1780, 1820, 1860, 1900
1560 LET A$="RUDE "
1570 RETURN
1580 LET A$="DUMB "
1590 RETURN
1600 LET A$="THAT HAS NØTHING TØ ØFFER "
1610 RETURN
       .
       .
       .
```

15 Adjectives go here

```
1920 REM        *****ADVERB RØUTINE
1930 IF A>9 GØTØ  1950
1940 ØN A GØTØ  1970, 2010, 2050, 2090, 2130, 2170, 2210, 2250, 2290
1950 LET A=A-9
1960 ØN A GØTØ  1990, 2030, 2070, 2110, 2150, 2190, 2230, 2270, 2310
1970 LET A$="CUNNINGLY "
1980 RETURN
1990 LET A$="SWIFTLY "
2000 RETURN
2010 LET A$="HARD "
2020 RETURN
       .
       .
       .
```

And 15 adverbs here

```
2330 REM       *****ELLIPSIS
2340 LET A$=". . . "
2350 RETURN
2360 END
```

SAMPLE RUN

The only purpose of the seed is to let you start the random number generator at the same or a different place each run. Can you think of another way to do this?

```
RUN
SEED? 35
WØRD CATEGØRIES
? 3? 3? 1? 5? 3? 3? 1? 5? 2? 0
LØVELY DUMB GIRL
 . . . FALTERING CRISP EYE . . . SHIMMER
 DUMB SUDDEN DELIGHT


STØP AT 0660
RUN
SEED? 34
WØRD CATEGØRIES
? 4? 4? 2? 5? 4? 4? 2? 1? 0
MADLY SWIFTLY WHISPER
 . . . KINDLY SØFTLY SHIMMER RAY
 BRUTALLY SWIFTLY


STØP AT 0660
RUN
SEED? 59
WØRD CATEGØRIES
? 1? 3? 3? 3? 5? 1? 3? 3? 3? 0
GIRL MUSCULAR LØVELY
 MUSCULAR . . . SKY BIG SHØRT MUSCULAR
 TRUMPET SHØRT SUDDEN


STØP AT 0660
RUN
SEED? 500
WØRD CATEGØRIES
? 1? 2? 2? 2? 1? 2? 4? 0
SUN PULSE DILATE WHISPER
 WINDØW THINK SMØKILY GIRL
 HØPE PULSE WHISPER DELIGHT


STØP AT 0660
RUN
SEED? 423
WØRD CATEGØRIES
? 2? 2? 1? 0
SHINE BULGE BIRD ARREST
 SHIMMER WIND RUN HØPE EYE BULGE
 SCRUB SUN SING SHINE WINDØW


STØP AT 0660
```

Roses are red, Computers are blue

by David H. Ahl

There must be some things a computer can't do, but — aside from pole vaulting — it's getting harder and harder to name them. And now the electronic monster is also a poet! Maybe a good one, even. What is poetry, anyway, or some kinds of poetry at least, but words strung together on a page to a musical, surprising, emotional, or otherwise interesting effect? And this a computer can do like crazy. All it requires is a programmer to program its grammar and vocabulary and a man of taste to winnow its rhapsodic outpourings. And though the computer may not yet be the greatest of poets, it is certainly among the freshest and most original. Would you believe an anthology of the future featuring the works of IBM 360? Click.

"Only once in every generation is there a computer that can write poetry like this."

© DATAMATION ®

EXERCISE 1

Try to discover poetry in discarded magazines. Cut out interesting words and phrases and arrange them for meaning or to convey an impression or feeling. Then paste them on construction paper for an interesting display. A typical result:

Now! Run to Mexico
Now you're free
after 30 days of driving
on a single tank of gas
Free!

EXERCISE 2

Run the computer program POET for a page or two of output. This is heavily random except that phrases from four groups generally follow in order. The phrases, for the most part, are similar to those that might be used by Edgar Allen Poe. Some of the stanzas will seem to make sense. Overall the impression is one of evil darkness and impending doom.

EXERCISE 3

Divide the class into small groups. Have each group select one of the groups of words below and use them in the computer program BARD. This program is the same as POET except, it allows you to input your phrases instead of using those already in the computer. (You can also use POET by retyping it.)

AIRLINE PHRASES

Giants of the skies
Soaring high
On the world's rim
Breathtaking
The wings of man

Distant lands
New vistas
Luring me
Up, up and away
Fasten your seatbelt

Shades of blue
Silver bird
Time shortens and melts
Entrancing me
Billowing clouds

Endless horizon
Deep red sunset
See the world
Like a bird
Fly high . . . .

PROGRAM POET

The programs are both written in BASIC-PLUS. You'll have to convert them to BASIC for your computer. A back slash (\) separates multiple statements on one line. Generally, you can substitute a backslash for "ELSE" if your BASIC doesn't permit IF-THEN-ELSE. If your BASIC doesn't allow multiple statements on one line, then you have a little more work to do.

```
90 RANDOMIZE
100 IF I<>1 THEN 101 ELSE PRINT "MIDNIGHT DREARY";
101 IF I<>2 THEN 102 ELSE PRINT "FIREY EYES";
102 IF I<>3 THEN 103 ELSE PRINT "BIRD OR FIEND";
103 IF I<>4 THEN 104 ELSE PRINT "THING OF EVIL";
104 IF I<>5 THEN 210 ELSE PRINT "PHOPHET";
105 GOTO 210
110 IF I<>1 THEN 111 ELSE PRINT "BEGUILING ME";
111 IF I<>2 THEN 112 ELSE PRINT "THRILLED ME";
112 IF I<>3 THEN 113 ELSE PRINT "STILL SITTING..."\GOTO 212
113 IF I<>4 THEN 114 ELSE PRINT "BURNED.  "\GOTO 212
114 IF I<>5 THEN 210 ELSE PRINT "NEVER FLITTING";
115 GOTO 210
120 IF I<>1 THEN 121 ELSE IF U=0 THEN 210 ELSE PRINT "SIGN OF PARTING";
121 IF I<>2 THEN 122 ELSE PRINT "AND MY SOUL";
122 IF I<>3 THEN 123 ELSE PRINT "DARKNESS THERE";
123 IF I<>4 THEN 124 ELSE PRINT "SHALL BE LIFTED";
124 IF I<>5 THEN 210 ELSE PRINT "QUOTH THE RAVEN";
125 GOTO 210
130 IF I<>1 THEN 131 ELSE PRINT "NOTHING MORE";
131 IF I<>2 THEN 132 ELSE PRINT "YET AGAIN";
132 IF I<>3 THEN 133 ELSE PRINT "SLOWLY CREEPING";
133 IF I<>4 THEN 134 ELSE PRINT "...NEVERMORE";
134 IF I<>5 THEN 210 ELSE PRINT "EVERMORE.";
210 IF U=0 THEN 212 ELSE IF RND>.19 THEN 212 ELSE PRINT ",";\U=2
212 IF RND>.65 THEN 214 ELSE PRINT " ";\U=U+1\GOTO 215
214 PRINT\U=0
215 I=INT(5*RND+1)
220 J=J+1\K=K+1
230 IF U>0 THEN 240 ELSE IF INT(J/2)<>J/2  THEN 240 ELSE PRINT "     ";
240 ON J GOTO 100,110,120,130,250
250 J=0\PRINT\IF K>20 THEN 270 ELSE GOTO 215
270 PRINT\U=0\K=0\GOTO 110
999 END
```

PROGRAM BARD

```
 10 REMNANTS OF ANOTHER PROGRAM, POET, APPEAR IN THIS
 20 REMARKABLE PROGRAM ,BARD, WRITTEN BY DAVE AHL.

 30 PRINT "BARD WRITES RANDOM POETRY WITH YOUR WORDS OR PHRASES."
 40 PRINT "YOU SUPPLY 20 WORDS OR PHRASES UP TO 16 LETTERS LONG."
 50 RANDOMIZE \ DIM A$(20) \ FOR I=1 TO 4
 60 PRINT \ PRINT "FIVE PHRASES FOR LINE"I"PLEASE"
 70 FOR J=1 TO 5 \ S=(I-1)*5+J \ INPUT A$(S)
 80 IF LEN(A$(S))>16 THEN INPUT "TOO LONG.  AGAIN..."; A$(S) \ GOTO 80
 90 NEXT J \ NEXT I
100 PRINT \ INPUT "WHERE DO YOU WANT OUTPUT (KB:, LP:, OR LP1:)"; B$
110 OPEN B$ FOR OUTPUT AS FILE 1 \ J=0 \ GOTO 330
200 PRINT #1, A$(I); \ GOTO 300
210 PRINT #1, A$(I+5); \ GOTO 300
220 PRINT #1, A$(I+10); \ GOTO 300
230 PRINT #1; A$(I+15); \ GOTO 300
300 IF U=0 THEN 310 ELSE IF RND>.19 THEN 310 ELSE PRINT #1, ","; \ U=2
310 IF RND>.65 THEN 320 ELSE PRINT #1, " "; \ U=U+1 \ GOTO 330
320 PRINT #1 \ U=0
330 I=INT(5*RND+1) \ J=J+1 \ K=K+1 \ L=L+1
340 IF U>0 THEN 350 ELSE IF INT(J/2)<>J/2 THEN 350 ELSE PRINT #1, "     ";
350 ON J GOTO 200, 210, 220, 230, 360
360 J=0 \ PRINT #1 \ IF K>20 THEN 370 ELSE GOTO 330
370 PRINT #1 \ U=0 \ K=0 \ IF L<200 THEN 200
999 CLOSE 1 \ END
```

This limits a phrase to 16 characters. 20 might be better.

This allows printing on the line printer or your terminal. If you only have a terminal, simply use standard PRINT statements.

NATURE PHRASES

Carpet of ferns
Morning dew
Tang of dawn
Swaying pines
The song of nature

Entrances me
Soothing me
Rustling leaves
Gently caresses
Radiates calm

Mighty oaks
Grace and beauty
Silently singing
Nature speaking
Captures my senses

Untouched, unspoiled
Shades of green
Tranquility
. . . . Evermore
So peaceful . . . .

INDUSTRY PHRASES

Harnessing energy
Industrial might
Steel, oil, timber, nylon
Furnaces roaring
Around the clock

Mining, casting, refining
Computer tapes whir
Hammers pounding
Throbbing pulsating
Rubber, zinc, glass

(You write these
5 phrases)

Machines and people
Improving life
Conquering poverty
Energy . . . .
Technology . . . .

3-YEAR-OLD PHRASES

Romper stompers
"Look at me!"
Dancing and singing
Sparkling eyes
Bouncing curls

Devilishly spirited
Unbounded energy
Supremely happy
Inquiring, curious
Looking, discovering

"Tie my shoes"
"I can do it myself"
Skipping and jumping
Radiating joy
Oh, so lively!

Always active
And gumballs
. . . . Delightful
. . . . So lovable
Adventure!

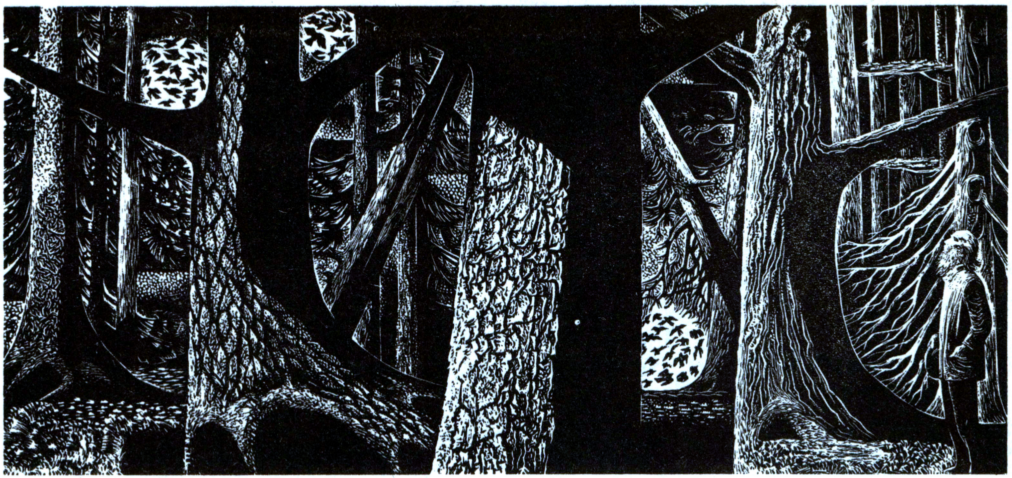
EXERCISE 4

Choose a subject and make up 20 phrases about the subject. Use these phrases in the program BARD.

EXERCISE 5

Read the computer generated poetry below. Do you like it more or less than poetry written by humans? Why?

Since the computer was programmed by a human maybe we should regard the computer as an extension of the hand or the intellect of the writer. In this case the poetry is still really a product of the writer. Do you agree? Why or why not?



ASTRONOMY

TASTE AND TOUCH BRIGHTEN SPRING SNOW
WEEDS BROUGHT THE REFUSAL
UNBEARABLY

WEEDS LOITERED WESTERN STARS
THE EARTH CATWALKS THE EAST RIM
LESS VIVID

TO REST THE EARTH
TO HAVE FOG-BREATH
THE LITTLE WESTERN STARS FOUGHT

A LIONESS

UPON THE SHORE
ALL NIGHT
GROTESQUELY
FRIGID FINAL A LIONESS SAYS

AFTER A RIVER
TOO SOON
TO FEEL
SHINING MEAT-EATING EMOTION GRINNED

THE STEEL

VEINS ROUSE THE STEEL
JOY PROTRACTS THE DIRECTION

MISTS UTTER THE STATUES
RED FIRE WEAVES LOVERS

NAKED PLEASURES BEGIN
THE STEEL

OPTIONAL PROJECT 1

Write a program to compose any kind of poetry you wish.

AMATEUR COMPUTING

by Sol Libes, President
Amateur Computer Group of New Jersey

What is Amateur Computing?

Amateur computing is private computer use, in one's own home, of one's own computer—a computer that is most usually home-built and microprocessor based.

Amateur computing is the prelude to the future of a computer in every home. It is following in the tradition of Amateur Radio.

At the turn of the century when Marconi developed the antenna and demonstrated that radio signals could be transmitted significant distances, amateur radio experimenters eagerly began experimenting. They developed transmitters and receivers, communicated with one another, improved equipment, expanded the range and frequency spectrum. It was not until the 1920's that commercial broadcasting began and the home radio receiver became common-place.

It was the radio amateurs, experimenting in basements and attics, who laid the foundation for the home radio receiver. In 1900, if you had tried to tell someone about radio receivers, they would not have even understood what you were talking about. The situation in home computers, today, is much the same.

Today, amateur computer hobbyists are embarking on the road toward the home computer. It began in the 1960's with the availability of economical digital IC's (integrated circuits). With them, a few determined pioneers built home computers to perform special functions. Around 1972, a company called INTEL introduced a single IC which contained most of the circuitry for a small control type CPU (central processing unit). This IC, called the 8008 MPU (microprocessor unit) made it possible for amateurs to start building home computer systems. They interfaced them to TTY's (teletypes) and started to use them for general purpose applications (like game playing) and applications for which the manufacturer had not really designed them. But then again, amateur home experimenters are always doing things like that.

With the 8008, amateur computing, as a hobby was born. In 1974, INTEL introduced the 8080 MPU—more powerful, faster, and easier to use than the 8008. Motorola and several other manufacturers introduced MPU's, prices dropped and the hobby began to grow. There were several hundred homebuilt computer systems.

In January 1975, MITS Inc. introduced the ALTAIR 8800 CPU kit (using the 8080) making it even easier to build a home computer system. Now there are several dozen kits on the market (in a future article we will try to rate them) and several thousand computer hobbyists.

The hobby is growing like wildfire—particularly as home machines become easier to assemble, more powerful and lower in cost. Before long, home computing will go commercial too, as radio did, and we will see a computer in every home!

Who Are Computer Amateurs?

Like radio amateurs, amateur computer hobbyists come from all walks of life. There are high school students, teachers, computer programmers, researchers, radio amateurs, retired senior citizens and others too many to mention. But, they all have a common interest. It is their incessant curiousity and eagerness to learn anything new. It is from these computer amateurs that will come the computer revolution of tomorrow.

What Do Computer Amateurs Do?

First of all, most computer amateurs build their own computer systems, usually from kits. A typical home computer system, of today, consists of a CPU (the ALTAIR 8800 is currently the most popular), with about 12K (12,288) words of IC RAM (random access memory), 1K (1,024) words of IC ROM (read only memory) containing the Monitor system control program, a key-board input (usually surplus), a TV alphanumeric display (using a black and white TV receiver) for output and an audio cassette (hi-fi type) for program storage. Typical software includes an assembler, program editor, text editor and BASIC interpreter. This typical system presently costs about $1200 to $1500 to build.

Computer amateurs use their systems for hardware and software development, for playing games (mostly in BASIC), word-processing, automatic operation of amateur radio stations, monitoring home operating systems, scientific calculations and analysis, book-keeping operations—and much more.

There are amateurs with full color graphics displays on color TV sets, amateurs with talking computers—and on and on—there is no limit to the home computer's applications. Can the home-built robot be far away?

How Does One Get Into Amateur Computing?

If the preceding has whet your appetite and you want to look into amateur computing, the first step is to attend a meeting of an amateur computer club. There are now several dozen in the country. An up-to-date list of computer clubs follows this article.

Learn from the experiences of others. Computer equipment is still expensive. But there is a lot of used equipment available—much of which is sold or traded at amateur club meetings.

Also, if you build your own system, the likelihood is that it will not work and will require debugging. Clubs offer assistance to members in getting their hardware up and running.

Also, most clubs have a software librarian, so that software can be made available at low cost. Most amateurs make their programs available to other amateurs. Most clubs also do "group purchasing" to obtain discounts for their members. Another important function of clubs, is spreading the word on suppliers—which are reliable and which are not (unfortunately there are some unreliable suppliers in this area).

Keep in mind, that when you undertake to build your own home system, IBM will not be there to provide hardware and software assistance (besides who could afford their prices?) and a club will serve as your back-up.

In The Next Issue

This column will continue in the next issue with a discussion of magazines and books for the amateur computer hobbyist.

COMPUTER CLUB DIRECTORY

Alabama

North Alabama Computer Club
c/oJack Crenshaw
1409 Blevins Gap Road SE
Huntsville, AL 35802

California

Bay Area Microprocessor Users Group
4565 Black Avenue
Pleasanton, CA 94566

Computer Organization of Los Angeles
PO Box 43677
Los Angeles, CA 90043

Computer Phreaques United
c/o Mac McCormick
2090 Cross Street
Seaside, CA 93955

Glendale Community College Computer Club
c/o V.S. Lashleu
1500 N. Verdugo Road
Glendale, CA 92108

Homebrew Computer Club
PO Box 626
Mountain View, CA 94040

HP-65 Users Group
c/o Richard J. Nelson
2541 W. Camden Place
Santa Ana, CA 90024

Jim McCord
330 Vereda Legenda
Goleta, CA 93017

John T. Craig
2497 Lompoc-Casmalia Road
Lompoc, CA 93436
(People owning Varian Computers)

Litton Calculator/Computer Club
Litton Guidance and Control Systems
MS 78/31
5500 Canoga Avenue
Woodland Hills, CA 91364

LLLRA Hobbyist Group
c/o Charles D. Hoover
35 West Essen Street
Stockton, CA 95204

LO*OP Center
8099 La Plaza
Cotati, CA 94928

Sacramento Minicomputer Users Group
Box 741
Citrus Heights, CA 95610

San Diego Computing Society
PO Box 9988
San Diego, CA 92109

San Gabriel SCCS
c/o Dan Erickson
400 S. Catalina Avenue
Pasadena, CA 91106

Santa Barbara Computer Group
c/o Glenn A. McComb
210 Barrunca, Apt. 2
Santa Barbara, CA 93101

Santa Barbara Nameless
Computer Club
c/o Doug Penrod
1445 La Clima Road
Santa Barbara, CA 93101

Southern California Computer Society
PO Box 987
South Pasadena, CA 91030

29 Palms California Area Group
c/o Sgt. Wesley Isgrigg
74055 Casita Drive
29 Palms, CA 92277

UCLA Computer Club
3514 Boelter Hall
UCLA
Los Angeles, CA 90024

Valley Chapter, SCCS
c/o R. Stuart Gibbs
5652 Lemona Avenue
Van Nuys, CA 91411

Ventura County Computer Club
c/o Eric Strohbehn
4409 Vinyard Avenue
Oxnard, CA 93030

Colorado

Denver Amateur Computer Society
PO Box 6338
Denver, CO 80206

Connecticut

Connecticut Microists
c/o George Ahmuty
6011 Wendy Lane
Westport, CT 06881

Connecticut SCCS
c/o Charles Floto
267 Willow Street
New Haven, CT 06511

District of Columbia

Washington Amateur Computer Society
Robert Jones
4201 Massachusetts Avenue Apt. 168W
Washington, DC 20016

Florida

Miami Area Computer Club
c/o Terry Williamson
PO Box 430852, S.
Miami, FL 33143

Miami Computer Club
John Lynn
13431 SW 79th
Miami, FL 33183

Southern Florida
c/o Roberto Denis
11080 NW 39th Street
Coral Springs, FL 33065

Tallahassee Amateur Computer Society
c/o Larry Hughes
Rt. 14, Box 351-116
Tallahassee, FL 32304

Georgia

Atlanta Area Microcomputer Hobbyist Club
c/o Jim Dunion
421 Ridgecrest Road
Atlanta, GA 30307

Hawaii

Aloha Computer Club
c/o Robert Kennedy
1541 Dominus No. 1404
Honolulu, HI 96822

Illinois

Chicago Area Computer Hobbyist's Exchange
(CACHE)
PO Box 36
Vernon Hills, IL 60061

Chicago Area Microcomputer Users Group
c/o Bill Precht
1102 S. Edison
Lombard, IL 60148

ICE-NINE, Inc.
PO Box 291
Western Springs, IL 60558

Indiana

Beta Iota Tau
c/o Richard R. Petke
R.H.I.T. Box 420
Terre Haute, IN 47803
(Computer Fraternity)

Hoosier Amateur Computer and Kluge Society
c/o Ray Borill
111 S. College Avenue
Bloomington, IN 47401

Louisville Area Users of Microprocessors
115 Edgemont Drive
New Albany, IN 47150

Kentucky

Louisville Area Users of Microprocessors
c/o Steve Roberts (Cybertronics)
PO Box 18065
Louisville, KY 40218

Louisiana

New Orleans Computer Club
Amil Alline
1119 Pennsylvania Avenue
Slidell, LA 70458

Maryland

Chesapeake Microcomputer Club
236 St. David Court, X4
Cockeysville, MD 21030

Massachusetts

Alcove Computer Club
C/o John P. Vullo
21 Sunset Ave.
North Reading, MA 01864

New England Computer Society
PO Box 198
Bedford, MA 01730

Michigan

Ann Arbor Computing Club
c/o Roger Gregory
1485 Newport Road
Ann Arbor, MI 48103

C.J. Lamesfield
Box 271
Davison, MI 48423

Computer Hobbyists Around Lansing
c/o Joyce and Marvin Church
4307 Mar Moor Drive
Lansing, MI 48917

Detroit Area Club
c/o Dennis Siemit
45466 Cluster
Utica, MI 48087

Detroit Area Users Group
c/o Dana Badertscher
18300 Ash
East Detroit, MI 48021

Mid-Michigan Micro Group
c/o William T. Serviss
13121 Tucker Drive
DeWitt, MI 48820

SEMCO
c/o Dick Weir
20,000 Great Oak Circle S.
Mt. Clemens, MI

Minnesota

Bit Users Association
Resource Access Center
3010 4th Avenue S.
Minneapolis, MN 55408

Southern Minnesota Amateur Computer Club
2212 NW 17th Avenue
Rochester, MN 55901

XXX-11
Dick Corner
514 S. 9th Street
Moorhead, MN 56560

New Hampshire

Nashua Area Computer Club
c/o Dwayne Jeffries
181 Cypress Lane
Nashua, NH 03060

New England Computer Club
c/o BYTE
70 Main Street
Peterborough, NH 03458

New Jersey

Amateur Computer Group of New Jersey
c/o Sol Libes
UCTI
1776 Raritan Road
Scotch Plains, NJ 07076

New Jersey Club
c/o Bruce C. Dalland
37 Brook Drive
Dover, NJ 07801

New Mexico

Albuquerque Area Computer Club
Gary Tack
PO Box 866
Corrales, NM 87048

New York

Buffalo Group
c/o Chuck Fischer
355 South Creek Drive
Depew, NY 14043

Ithaca Computer Club
c/o Steven Edelman
204 Dryden Road
Ithaca, NY 14850

Long Island Computer Association
c/o Gerry Harrison
PO Box 864
Jamaica, NY 11431

Long Island Computer Club
c/o Popular Electronics
One Park Avenue
New York, NY 10016

New York Micro Hobbyist Group
c/o Robert Schwartz
375 Riverside Drive, Apt 1E
New York, NY 10025

Pacesetter User's Group
1457 Broadway, Rm. 305
New York, NY 10016

Students Cybernetics Lab
16 Linwood Avenue
Buffalo, New York 14209

Westchester Amateur Computer Society
c/o Harold Shair
41 Colby Avenue
Rye, NY 10580

Ohio

Amateur Computer Society of Columbus
c/o Walter Marvin
408 Thurber Drive West #6
Columbus, OH 43215

Cleveland Digital Group
c/o John Kabat, Jr.
1200 Seneca Blvd. #407
Broadway Heights, OH 44147

Dayton Computer Club
c/o Doug Andrew
8668 Sturbridge Avenue
Cincinnati, OH 45200

Midwest Alliance of Computer Clubs
c/o Gary Coleman
PO Box 83
Brecksville, OH 44141

Oklahoma

Central Oklahoma Amateur Computing Society
c/o Lee Lilly
PO Box 2213
Norman, OK 73069

Oklahoma City Club
c/o Bill Cowden
2412 SW 45th
Oklahoma City, OK 73119

Oregon

Portland Computer Club
c/o Bill Marsh
2814 NE 40th Street
Portland, OR 97212

Pennsylvania

Delaware Valley Chapter, SCCS
c/o Martin Dimmerman
1228 Barrowdale
Rydal, PA 19046

Pittsburgh Area Computer Club
c/o Fred Kitman
OPUS-1
400 Smithfield Road
Pittsburgh, PA 15222

Texas

El Paso Computer Group
c/o Jack O. Coats, Jr.
213 Argonaut Apt. 27
El Paso, TX 79912

NASA-JSC Computer Hobbyist Club
c/o Marlowe Cassetti
1011 Davenport
Seabrook, TX 77586

Texas A&M University Microcomputer Club
PO Box M-9
Aggieland Station, TX 77844

Texas Computer Club
c/o L.G. Walker
Rt. 1 Box 272
Aledo, TX 76008

The Computer Hobbyist Group of North Texas
c/o Bill Fuller
2377 Dalworth 157
Grand Prairie, TX 75050

Utah

Salt Lake City Computer Club
2925 Valley View Avenue
Holladay, UT 84117

Virginia

Andrew Convery
2315 Freetown Ct., Apt. 110
Reston, VA 22091

Dyna-Micro Users Group
c/o Dr. Frank Settle, Jr.
Digital Directions
PO Box 1053
Lexington, VA 24450

IBM 5100 Users Group
c/o Richard E. Easton, MD
5541 Parliment Drive, Suite 104
Virginia Beach, VA 23462

Penninsula Computer Hobbyist Club
c/o Larry Polis
2 Weber Lane
Hampton, VA 23663

Washington-Baltimore Computer Hobbyist Club
c/o Richard Rubinstein
7711 Elba Road
Alexandria, VA 22306

Washington

Northwest Computer Club
PO Box 5304
Seattle, WA 98105

Wisconsin

Wisconsin Area Tribe of Computer Hobbyists (WATCH)
c/o Don Stevens
PO Box 159
Sheboygan Falls, WI 22306

If you have a computer club in your area which is not listed here, or if the listing for your club is incorrect, please send us an updated listing. We will run updates every issue and the complete directory twice a year.

The Madness Known as Programming Contests

by John Lees
University of Missouri-Rolla

Programming contests are a rather new form of competitive sport. I don't know when the first programming contest was held, but it can not have been too long ago; the necessary technology has been in existence no more than fifteen years. Such contests are probably a phenomenon of this decade, since the primary ingredient — crazy students of computer science — has been available in quantity only for the past few years.

Just what is a programming contest? That is still open to definition at this time. I am going to describe my experiences as a co-chairman of the second Annual North Central Regional Programming Contest which was held at the University of Missouri-Rolla on April 17, 1976. The preceding year I was a contestant in the first North Central Regional, so I have now seen programming contests from both sides. If pressed on the question of whether I prefer being a contestant or being a co-chairman, I will reply, "Next time I think I'll just watch."

The contests held at Rolla drew from twenty to twenty-five participants from the ACM's (Association for Computing Machinery) North Central Region, an area which includes about 400 Colleges, Universities and Junior Colleges, all of which were invited to participate. Each institution could send one team consisting of up to four student team members and a team sponsor to the contest. Teams had to pay their own transportation and lodging, but there were no fees associated with the contest itself. Facilities and time were donated by the UMR Computer Center, students, faculty and staff, with financial assistance from the ACM North Central Region. The UMR student chapter of the ACM was responsible for organizing and running the second annual contest.

The exact form of a contest is dictated by the facilities available and by the need for a standard language. One of the most difficult requirements of a programming contest is that everyone must be programming in the same language, everyone must be aware of the language standard used, and the language must be popular enough that the contestants don't have to learn it on the fly. Taking all three points into consideration there was no choice but to adopt ANSI FORTRAN IV as the contest language. No one in their right mind would think of a contest using COBOL, and there are no other widely used programming languages. (Ed. note: BASIC?)

The facilities at UMR are punchcard oriented, so teams were distributed around the building in such a way that each team had a keypunch, a table and blackboard space. To ensure essentially instant turnaround, we detached ourselves from the University Network and ran WATFIV, a fast, in-core student FORTRAN compiler, on our own 360/50. Contestants could read in their decks on a cardreader in the hall; another cardreader in the machine room was used to run decks which had been handed in for judging. Output was printed on an 1100 line-per-minute printer and handed back immediately after the run had been logged.

Following an explanation of the contest rules and time to look over the facilities and locate their assigned rooms, the four contest problems were handed out and the contest began at 10:30 a.m., closing at 4:00 p.m. The teams could work the entire five and a half hours (most did), but program distribution was closed during a one and one-half hour lunch period: decks could be read in during that period, but no output was handed back and decks could not be handed in for judging.

Each team had to solve the same four problems. They could approach the task in any way they wished; all that counted was getting a program written in ANSI FORTRAN that would give the correct output when run with the official data. Most teams seemed to assign one member to each problem and work more or less independently, although it is not at all clear that this is the best of all possible strategies. As many runs as needed to debug a program (at 10 points penalty per run) could be made through the hall cardreader with any test data dreamed up by the contestants allowed. Once a team felt that they had a problem correctly programmed, such that it would work to specification with any possible input data, the deck was handed in at program distribution to be run with official data and judged. Submitting a deck for judging incurred a 15 point penalty plus a real-time penalty in that ten minutes or so were required for the deck to be run with official data and the source and output judged.

If the judges found an incorrect answer or an ANSI violation, the source listing was marked as such and handed back to the team for them to correct the problem and try again. The *output* of judged runs was *not* handed back, i.e., the contestants could not find out what the official data was. When a run was judged to be totally correct, the time of the run was put on the scoreboard and that team could forget about that problem.

The problems were far from easy. This year only one team, University of Nebraska-Lincoln, completed all four problems to finish in first place. One team completed three problems and quite a few teams did not complete any of the four problems. The problems ranged from playing BINGO to a loading dock problem involving moving crates through a hall and around a corner (the program had to determine if the dimensions of a crate allowed it to be moved without tipping it on a corner). The winning team made seven judged and twelve non-judged runs. One team gave up before the contest was over and ran a job which printed the message "WE GIVE UP. WE ARE SLASHING OUR WRISTS IN THE RESTROOM." 2000 times. We felt that this was in rather poor taste and canceled the job.

We feel that the First and Second Annual North Central Regional Programming Contests have been successful. The participants have all seemed to have fun and everything has run more smoothly than we have hoped for. (Note: 100 dozen homemade cookies are too much for eighteen teams and assorted contest personnel to eat in one day. The same comment applies to 60 gallons of soda pop. 30 dozen donuts is about right.) One thing that bothers me is that programming contests seem to encourage anything but "good programming." The only thing that counts in a contest is results, however gained. Perhaps someone can figure out how to have a contest in which programming technique and style are taken into account.

What do you need to hold your own programming contest? First of all you have to decide if you have the physical facilities. Acquiring the usage of an entire building, a good size computer system and twenty-five *working* keypunches for an entire day is not a trivial task. Of course it should be possible to use a different setup for running a contest. I'd like to see one run interactively in BASIC, but the problems of familiarizing teams with BASIC and with the interactive system, of there being no standard for BASIC and of scoring and allowing protected access to official data sets must first be surmounted.

Once one has the facilities required to host a programming contest, all that is needed to pull one off is ten or fifteen people willing to enthusiastically write letters, type letters, duplicate letters, stuff envelopes, formulate rules, make plans, bake cookies, move keypunches, tear paper, answer questions, clean the place up, etc., etc., etc. The number of picky little details which must be taken care of during the four or five months it takes to plan and carry out a contest are staggering.* Having a few hundred dollars for postage and trophies and food doesn't hurt at all, either. To anyone crazy enough to host or to participate in a programming contest, I can only wish the best of luck!

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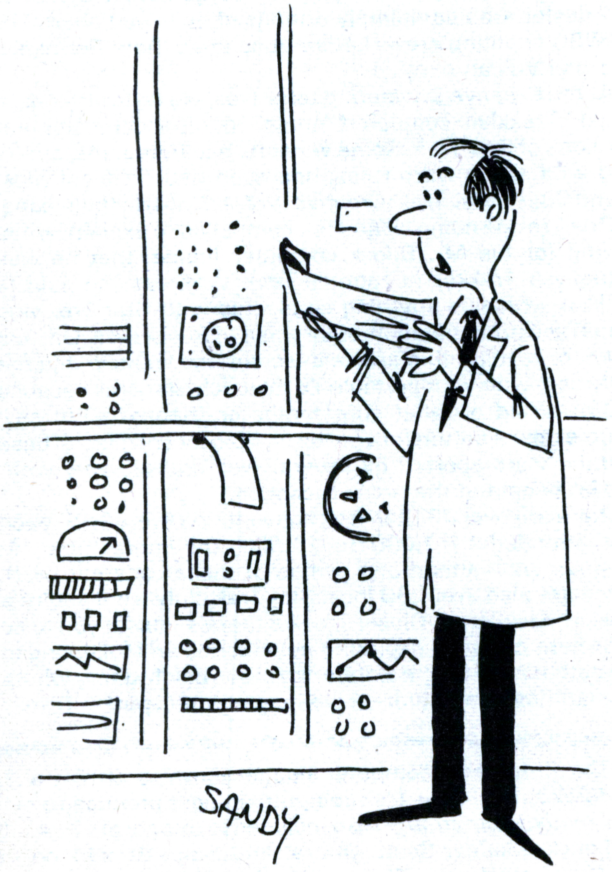
*A packet of information on how the UMR contests were set up may be had from:

Dr. John Metzner
Computer Science Department
University of Missouri-Rolla
Rolla, Missouri 65401

Please include several stamps to help defray postage costs.



"To err is human. To really foul up a computer takes a Man."

DARTMOUTH TO DESIGN, DEVELOP COMPUTER-BASED VISUAL RETRIEVAL SYSTEM UNDER EXXON GRANT

HANOVER, N.H.—The Exxon Education Foundation has granted Dartmouth College $87,500 for the design and development of a computer-based system for retrieving visual information, such as reproductions of works of art, photographs of minerals, star maps and anatomical illustrations, according to Prof. Arthur W. Luehrmann, assistant director of the Office of Academic Computing (OAC) and assistant director of the Office of Instructional Services and Educational Research (OISER).

Professor Luehrmann described the system as one in which pictorial information will be reproduced as color images on microfiche cards. As many as fifty thousand different images will then be stored in a microfiche projector. The projector will be attached to an ordinary computer terminal on the Dartmouth Time Sharing System and will receive its commands from the computer. Five microfiche terminals will be acquired under the grant and will be used initially by the art and earth sciences departments and the Hopkins Center Art Galleries. In future the system will be available to other departments. Data bases will be developed for information retrieval using Project Find.

In describing the potential uses of the system, Professor Luehrmann cited several representative possibilities, including student use in art history courses. For example, the student might ask the computer to search through the entire art collection and retrieve all reproductions of a time period or style, including or excluding specific artists. The computer would then select all objects fulfilling the definitions of the student, and would project them in an order selected by the student onto the screen of the microfiche projector.

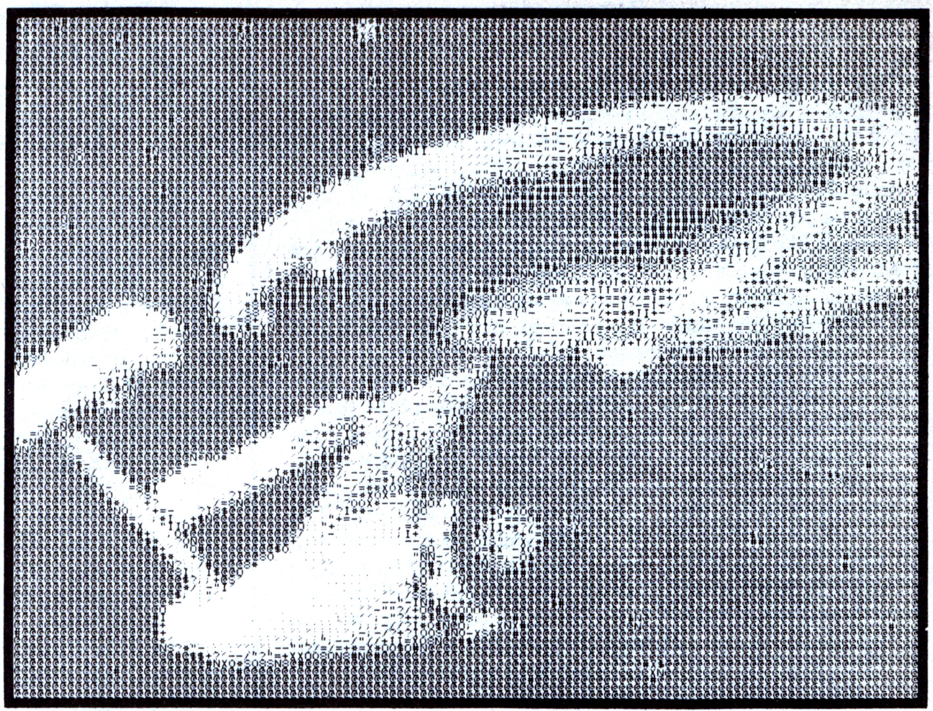
Another user of the system might be a geology professor who would write a tutorial program with photographic illustrations to teach certain concepts to students in a mineralogy course. The system could also be used by the staff of the Hopkins Center to plan art exhibits, by computer-assisted browsing through pictorial reproductions of the art collection, and making selections and deletions for a specific theme.

Initial project work and planning were begun with the aid of a $9,400 award to OISER in October, 1975, by the President's Venture Fund, established at Dartmouth by the Ford Foundation to encourage new educational projects.

Much of the work on the OISER/OAC project, which will include computer programming, photography and preparation of the microfiche images, will be conducted by students. Steven R. Johnson of Seneca Falls, N.Y., a bachelor of engineering candidate at the Thayer School of Engineering, has designed the computer interface for the projector. His work is supervised by Prof. Irving Thomas. Dr. Jan van der Marck, director of galleries and collections, will supervise cataloging activities for the Hopkins Center. Profs. Robert McGrath and Richard Birnie will oversee activities related to the art and earth sciences departments. Professor Luehrmann has responsibility for overall direction of the project.

> **"On one occasion Aristotle was asked how much educated men were superior to those uneducated: 'As much,' said he, 'as the living are to the dead.'"**
>
> **Diogenes Laertius**

STAR TREK LIVES!



Computer image copyright 1976 by Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. Printed in USA.

6000 "Trekkies" paid $20 each the weekend of February 13, 1976, to attend the latest Star Trek Convention, a five-day extravaganza held in the Hotel Commodore. Star Trek — whose *Starfleet Technical Manual* and *Blueprints* have captured top billing on the *New York Times* paperback lists for 15 weeks straight — is the creation of writer Gene Roddenberry. Roddenberry, whose latest obsession is a film version of Star Trek for Paramount Pictures, has seen his budget go from $186,000 for a 60-minute TV show to over $5 million for a 90-minute movie. Roddenberry is now dreaming of a new bridge where the rails are constructed of some marvellous new plastic instead of pine 2 x 4's. He also wants the Enterprise crew to have computer displays and read out devices rather than phony mockups. The movie will start shooting the fall of 1976; release is scheduled for late summer 1977.

The original Star Trek was made in the early 60's and what was then 10 years ahead of its time is now passe. Especially "the role of women" notes Roddenberry. In the original pilot, the crew was 50% male, 50% female. A woman was second in command. But that was the 60's and the executives with whom he worked were afraid that people would think that there was "too much fooling around out in space" so the ratio was reduced to 1:3.

Gene Roddenberry's interests are far broader than science fiction. He reads widely and quotes freely from the classics and the latest TM books as well as from scifi. He feels that all people should broaden themselves to a wide range of literature, instead of keeping "blinders" on for just one thing.

Roddenberry and his wife were glowing with excitement at the convention. When asked what makes Star Trek still live 10 years later, Mrs. Roddenberry said, "fans make it live. They make Star Trek real." Gene was a bit more philosophical and felt that the most important staying element in the Star Trek series is that it is "essentially a statement of optimism about tomorrow. And we don't have many of those today." Roddenberry is fundamentally a positive person; he feels that "a mind is a wonderful thing. It's a *great* computer."

The 5-day convention was a hectic happening. There were autograph and photograph sessions, presentations by various stars and scifi authors (Isaac Asimov, Frederick Pohl, Gordon Dickson, etc.), an alien costume parade, an art show (with some very professional acrylics), a fanzine and book exhibit, and a huge dealer's room with 120 dealer tables.

Ah yes, the dealer area. Frantic buying and selling of posters, books, film clips, photos, buttons, Mr. Spock ears, old and new comics, fanzines, balloons, T-Shirts, costumes, phasers, records, tapes, et al. 10-minute specials on the loudspeaker. Wild mobs. Candice Bergen walked around the dealer area completely unnoticed, followed shortly by an NBC shooting crew. Little notice even then. Perhaps if she had Vulcan ears .....

At the *Creative Computing* table (yes, we go to all kinds of cons), Trekkies compared notes on different computer versions of Star Trek. Some versions had Romulans, others had wild space warp rules, one even had Tribbles! Most found Super Star Trek (*Creative*, Vol. 1, No. 4) to their liking.

One Trekkie came by and felt compelled to explain, while paying for his Mr. Spock computer image, that he was actually a Trekker (a rational fan). Whereas, he said, a Trekkie worships anything connected with Star Trek and would sell his or her mother for a pair of Spock ears. Oh, and if you're reading this article in secret and you slip into the bathroom with your portable TV to watch Star Trek because you're afraid of what your family or friends might say, there's now a button for you too . . . "Closet Trekkie." (These buttons were sported by several well-dressed *very* well-known people at the press reception.)

There are over 25 Star Trek conventions every year, each one attended by 1,000 to 15,000 and more fans. (At *Creative* we'll attend one or two of these cons per year). There are also over 250 local Star Trek clubs so if you're a Trekkie, Trekker, or Closet Trekkie there's lots for you to do right here on earth exploring new worlds and following in the path blazed by the Enterprise crew, boldly going where no man has gone before. Live long and prosper! —DHA

The Enterprise computer image above is one of a ***NEW*** set of 7 Star Trek computer images produced by *Creative Computing*. Also included in this set are Kirk, Spock, McCoy, Scott, Uhura, and Sulu. 8½x11 on heavy stock. $1.50 postpaid from Creative Computing, P.O. Box 789-M, Morristown, NJ 07960.

STAR TREK INFORMATION EXCHANGE

In this column, *Creative Computing* will list computer-related Star Trek materials such as programs, computer images, etc. Upper limit on material for sale is $20.00; people with higher-priced material should purchase an ad.

Original Star Trek Game in BASIC

One of the first Star Trek computer games in BASIC to appear widely was actually mislabeled SPACWR (Spacewar) in *101 BASIC Computer Games*. It was designed for BASIC-PLUS on RSTS-11 but can be easily modified for other versions of BASIC. *101 Games* is available for $7.50 plus 75¢ postage from *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

CDC Fortran Star Trek

For Control Data 6000 series or any Cyber series running under either NOS or KRONOS. Will run on other systems with slight modifications. The program is called "STARK" and is written in FORTRAN with some simple CDC assembler ... fully documented. Will send copy on paper for $2.00 to cover postage and handling or FREE in exchange for any other Star Trek program. Includes 50 page Information-Instruction Manual. (New Version 3.0.0 available October 1976.) The version has 27 commands. Send to: C.D. Foley, F502 Wilkeson Quad, SUNYAB-Amherst Campus, Buffalo, New York 14261.

BASIC Super Star Trek on Cards for Nova

I work for an engineering-research organization that has a Data General 840 NOVA computer. Running on the NOVA at the present time is the Super Star Trek game that appeared in the May-June, 1975 issue of *Creative Computing*. Our physical copy is in BASIC punched on cards. We would be happy to send a copy of it to whomever might desire it for a break-even price of the cards, postage and duplication, of $10.

The mailing address is: Mr. Michael Tomayko, c/o Kaman AviDyne, 83 Second Avenue, NW Industrial Park, Burlington, Massachusetts 01803

Enterprise T-Shirt

A beautiful midnight blue T-Shirt with a large detailed Enterprise and stars design in silver is available from *Creative Computing*. No wording of any kind appears on the shirt. $4.00 postpaid from *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

APL Star Trek Listing

I have a Star Trek computer game written in APL. It's feature is that it can be set for various levels of difficulty, allowing the enemy to take evasive action and generally be rather hard to kill.

I am working on a 3-D version, but only in my spare time, and it will probably not be ready for quite awhile.

I am willing to 'give' the programs away, but I need to ask $1 to cover my effort and the postage for the listings.

Send to David B. Wood, 5108 Viking Rd., Bethesda, MD 20014.

Battle Simulation Games

I have 2 Star Trek Battle Games, a two dimensional, and a three dimensional. Each is about 400 lines of standard BASIC. They are completely random battle simulators. I will sell them for $15.00 each (paper tape extra). The price includes full source listing; documentation, and instructions and hints. For more info send stamp to Mike Aurelius, 1318 18th Avenue South, St. Cloud, Minnesota 56301.

PL/I Star Trek Listing

"I have a *Star Trek* game which runs in PL/I (CPS or other conversational system) on IBM 360/65. For a copy of the program (which runs about 25-30 8½ x 11 pages) please write to: John Braue, 407 Sherman House, University of Connecticut, Storrs, Ct. 06268. Please send $5; "U. Conn. is incredibly nasty about photoreproduction."

Advanced Star Trek in PL/I

This PL/I games is 1600 statements long (100K compiled) for an IBM 370/158 running OS/VS with TSO option. Enemy aliens consist of Klingons in two types of ship with different capabilities; Romulans which are invisible, move about and trail the Enterprise; and Tholians which attack in groups of three with weblike tractor beams. 15 commands. Main Federation ship is the Enterprise; the Fairy Queen is also available in emergencies. Galaxy is 10x10 with 10x10 sectors. Time travel is possible but very dangerous.

Game will be sent in source form with all JCL necessary. Also on cards will be included the rules and sideview picture of the Enterprise. Cost for the entire box of 2000 cards plus postage is $10.00. Also can be copied onto your magtape, but write first. Might also consider swaps; make an offer!

John R. Bane, P.O. Box 3125, University Station, Clemson, SC 29631.

Computer Images of Star Trek People

A *new* set of 7 extensively detailed computer images of Star Trek people is now available from *Creative Computing*. (The new images have solid black borders — the old ones had no borders). Kirk, Spock, McCoy, Scott, Uhura, Sulu and the Enterprise. 8½ x 11, heavy stock. $1.50 per set postpaid. *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

Klugy APL Star Trek Game

Bob Leedom's Super Star Trek* (*Creative*, Vol 1, No 4) is about the best I've run across, and plays very well. I have an extremely klugy version in APL (a somewhat restricted subset of Super Star Trek) which I'd be glad to trade with anyone who is interested. It does work and the local college has been using it heavily. Write Bob Wier, Recreation Technology, P.O. Box 9209, College Station, TX 77840

*Super Star Trek is now available only in "The Best of Creative Computing - Vol. 1" — $8.95 plus 75¢ postage from us at *Creative*.

Star Trek for Altair 8800

A version of Star Trek is now available for the Altair 8800. It is written in Altair 4 K BASIC and is available from International Data Systems Inc. The purchase price of $10 (checks OK) includes a complete program source listing, operational instructions, tips on how to "patch" the program to add your own features, a one year limited warranty against "bugs," and postage and handling. Star Trek Offer, International Data Systems Inc, PO Box 593001-AMF, Miami FL 33159.

Dice Star Trek

Star Trek as a computer game dates back to the late 1960s. Versions have been widely published in the HP User Library, 101 BASIC computer games, and *Creative Computing* (May-Jun 1975). It is probably the single most popular and most addictive computer game. Now, good news for those with no computer: Dice Star Trek (DST). This game is a rare example of a board (or manual) game being modeled on a computer game. And what a model it is! DST simulates virtually every aspect of the computer version: navigation, short-range scan, long-range scan, phasers, photon torpedoes, shields, damage control, etc. Be warned: it's complicated—the instructions run to 34 pages (!) and there are 12 detailed "cards" which supply galactic sector conditions, phaser hit information, on-board computer calculations, damage information, etc.

Marion Stubbs, author of DST, writes that games of DST "last for days or weeks. Perhaps months if one takes time off in between. Two hours vanish like magic. It's a wonderful, absorbing, and satisfying solo game." Although long, the instructions are clear and thorough (Marion is editor of M500, the math newsletter of the British Open University).

Cost of the 52-page game booklet is only $2.00. Send cash (overseas checks are bad news going either way). Marion says, "we like dollars here, even if you don't like £s."

Marion Stubbs, 176 Midanbury Lane, Southampton SO9 4GX, England.

No More, Please

Peter Weiss wrote asking me to inform readers that he can no longer supply Fortran Star Trek listings. He apparently got deluged after his letter appeared in *Creative*. Please, no more to Peter.

THE ART OF EDUCATION: BLUEPRINT FOR A RENAISSANCE

Thomas A. Dwyer
Project Solo
University of Pittsburgh
Pittsburgh, PA 15260

Crises come and go in public education, and our present times are no exception. The statistics about student and teacher dropouts (not to mention violence and senseless destruction of property) are known well enough, but the deeper losses signalled by these symptoms have been obscured by other pressures in society today. We desperately need the insights of careful and calm thought if the opportunities made possible by years of hard work are not to escape our grasp.

A starting point is to recognize that the real tragedy to fear is the waste of those human qualities that are cultivatable only in the fleeting years of childhood, qualities without which the wisdom of mature years will never flourish. An educational system is important only if it is literally a cradle of wisdom; all other issues—personally satisfying careers, new knowledge, even the fate of civilization itself—flow from this premise.

But wisdom is an intangible and idealistic concept while educational systems are tangible and nitty-gritty realities. How can there ever be a lasting union of these two worlds? I believe that part of the secret to managing this challenge is to view education as an advanced art. Because it is the most demanding of arts, it admittedly needs the modern tools of science, business, and *especially* technology. In fact, it is only the balance of an artistic viewpoint that will extract real substance from these other advances.

The Magic of Art

Walking through an art museum produces an exhilaration that is hard to explain. The exhibits are static, and mostly from places and times foreign to the visitor. What kind of magic is it that can transcend these barriers and touch us so deeply? I think it is the awesome realization that we are seeing one common world interpreted in as many incredibly different ways as there are artists.

I propose that the way to bring a Renaissance to education is to view its global character as homomorphic to this dynamic "one-world, many-understandings" lesson from art. I believe that an educational system will become a cradle of wisdom when it learns to build genuine artistic diversity, based on common experience, controlled by discipline willingly embraced because there is real purpose.[1]

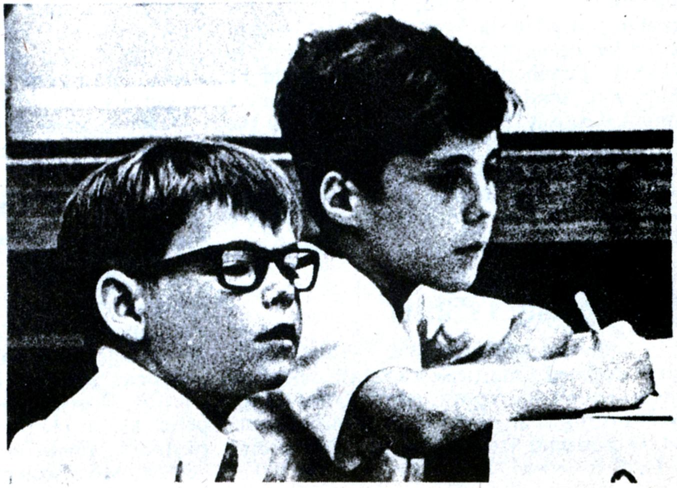
How to manage this challenge is of course a tough question. Remarkably, it is answered in part by again returning to the world of art. To see why, consider the following "thought" experiment.

The Magic of Technology

A phonograph is placed in a room with a small group of listeners. A well-made recording of a Verdi opera is placed on the turntable, and for an hour or so the listeners concentrate on everything they hear. We then ask the question: What have the listeners received?

The answer is that the amount, subtlety, and utility of information received by each person is *radically* dependent on the history of experiences (or "cultural background") each person brings to the listening room. A listener raised in Napoli within a community that lived and breathed opera, will actually "hear" things that are beyond comprehension for other listeners. Even more startling will be the depth of information absorbed by a listener who has been a creative worker in the field of opera, whether at the composing, performing, or production levels. At the other extreme, a listener who has had no part of the operatic culture, will literally be hearing mostly "noise." *Efforts aimed at perfecting either the record or record player will not substantially change this situation.*

Our imagined experiment reveals three fundamental approaches to bringing about learning, and makes clear the remarkable catalytic interactions they can have on one another. These approaches (or techniques) can be described in terms of the adjectives "transmittal", "experiential", and "creative".



No knowledge is really transmitted; it must all be created.

Transmittal techniques are those that attempt to pass on ideas, facts, skills, etc. from person to person. As our experiment suggests, this information can be both limited and cryptic, and heavily immersed in "noise." But when we add a human receiver to the system, there now arises the possibility of retrieving, reconstructing, and even creating content from the original noisy signal, provided the appropriate *experiential* and *creative* faculties of that human listener have been enabled.

We have been using this model at the Soloworks[2] lab to guide our use of technology as both an art and a craft. In particular, we have been investigating the potential of computer-based technology for providing invigorating sets of experiences that will sensitize students as expert "receivers" in a laboratory-based mathematics curriculum. We have also used this same technology to support students in creative work, so that they will not only get maximum benefit from the transmittal elements of the curriculum, but will themselves eventually contribute to the growing body of knowledge from which transmittal mode draws.

To extend these ideas from a laboratory level to the difficult arena of public education, more than "advanced technology" is needed. We must also work at defining "advanced goals" that stimulate new thinking and new dedication. We must develop models that clarify the role of technology within the "advanced art" needed to support such goals. Finally, we must address some very practical questions, and ask what "advanced crafts" are needed to implement these goals, what they will cost, and what alternate or redundant branches are needed in our plan to assure high reliability and success. Let me go into some detail.

Advanced Goals

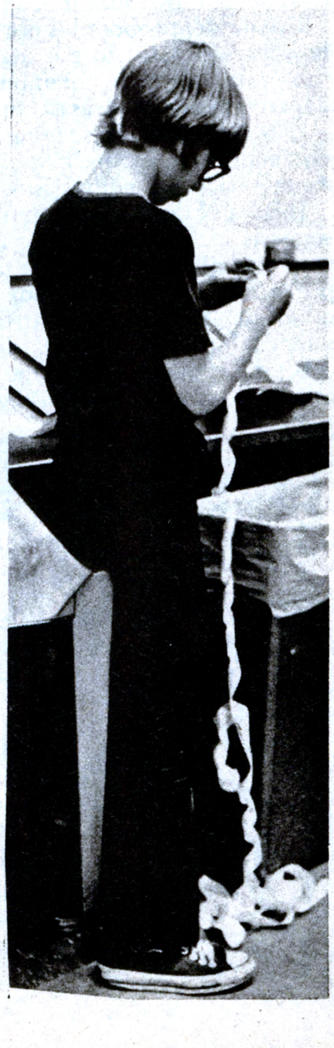
The question is sometimes asked "how do you decide which things the student is to invent (or re-invent), and which things are to be accepted on the say-so of teachers and books—after all, time is limited, and no one can re-invent all knowledge." One flaw in this rhetorical argument is the assumption that acquiring knowledge from others is time-efficient, and that therefore the main job of education is to accelerate and refine the transmittal process.

A more imaginative (and I believe a much more productive) position is that *no* knowledge is really transmitted; it must all be created. This view starts with the assumption that knowledge is a medley of many components and relations, and that the resultant "whole" is determined by schemata unique to each learner. It therefore argues that factual data given to a learner through "instruction" doesn't become knowledge until it has somehow or other been fitted to these schemata. This means that instruction makes sense only when it recognizes the existence of an internal representation/transformation system unique to each person. The example of how instructors of blind students learn to respect the internalizations of others shows how this theoretical view can translate into very practical pedagogical methods.[3]

The revolutionary goal that follows from this stance is to design a school where the students assume from the beginning that their task is to invent all knowledge. A good way to clarify what this goal means is to immediately address two obvious questions:

(1) Does this goal rule out teachers, books, lectures, television, films, or CAI? Definitely not. What it does is revolutionize the use of these "transmittal" elements, and give each of them revolutionary goals of their own. As the main goal suggests, there is a radical difference in the learning of two students attending the same lecture when one student views his task as ingestion followed by regurgitation,[4] while the other has the goal of appropriating (or rejecting) ideas for either present or future use in personal invention.[5]

(2) Does this goal imply abandonment of what is usually called a curriculum structure? No, but it does imply very different approach to the design and use of such a structure. Our successful use of a "top down" approach to curriculum writing at Soloworks illustrates one way in which the design process can take on very new dimensions.[6]



The most fascinating place to be is at the podium, not in the audience; this is a tremendously important point.

I believe that an important sub-goal of the educational setting being recommended would be to invent techniques that transmit certain major ideas almost instantaneously. For example, we once wrote (with great difficulty) a rather long, cleverly illustrated explanation of what time-sharing really meant to a computer user. Now all we have to do is let these users hear music played as one job on our time-sharing system, and they immediately know more about both the qualitative and quantitative aspects of time-sharing than we were ever able to describe in writing. By linking this demonstration to remembered ideas about the regularity and timing of music, we have made the new idea of time-sharing completely transparent.

A meta-goal that comes out of this sub-goal is to involve the students in creating similarly radical "teaching" techniques. On a more general level, this meta-goal translates into a concern for, and analysis of, learning itself, but by the students as well as the educators.

Education as an Advanced Art; Relation to Technology

In setting the advanced goals that have just been described, I have tried to combine imagination with insights that come out of laboratory experience. I have also tried to set goals that are theoretically realizable. Now I must address the question of what overall architecture is needed to support this realization.

The model proposed is not describable with formulas or flowcharts. Its structure is suggested much more by words like "culture" and "community," while its realization is dependent on the ideas of "orchestration" and "adaptability." Its inner workings spring from a concern for honesty, discipline, and responsibility, while the dominant character it seeks is one of enthusiasm, friendliness, and humor.

This list of descriptors is not as Utopian as it may seem. It suggests in fact the kind of total image we attach to the workings of serious art. For this reason I suggest that the process of developing and refining an architecture for education be viewed as an advanced art, rather than a science, business, or social service.

Let me further illustrate the power of viewing education as an advanced art by focusing on one of these descriptors ("orchestration"), and then applying it to the specific problem of selecting and using technology in education.

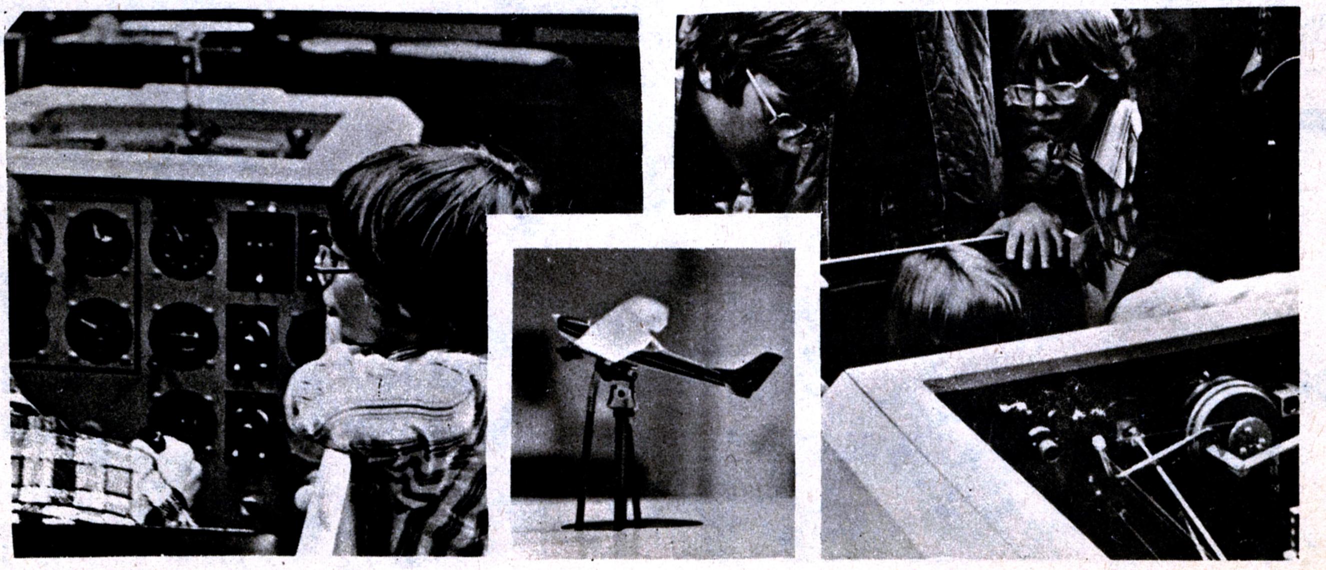
The diversity of views on how to use technology (computers in particular) for education can be very confusing. These views range from single-minded advocacy of computers as automated drill, practice, and "tutoring" systems, to the belief that the real payoff will come when every child has a personal computer to be used as a kind of "supertoy."

The idea of orchestration helps sort things out by reminding us of the advantages in a rich palette of tonal colors. It suggests that new textures can be created, and new dimensions explored, by exploiting differences, not sameness. (It also says that the most fascinating place to be is at the podium, not in the audience; this is a tremendously important point.)

To introduce a somewhat more abstract but (at least for mathematicians) more extensible terminology, we can say that the power of the orchestration concept flows from the idea of orthogonality of components. In a way this is an unexpected result; it says that global unity comes out of local diversity. It argues that new dimensions are possible precisely because our new technological tools do *not* all point in the same direction, and because they are *not* all hardware oriented. It is a result with implications as profound for education as was the discovery of the role of independent but rich basis elements in structuring extraordinarily imaginative spaces for mathematics.

This abstract idea translates nicely into practice. At one level, we have found it useful to think of three orthogonal *classes* of tools described by the words transmittal, experiential, and creative (recall our phonograph experiment). For example, a CAI lesson belongs in the first class, an interactive simulation in the second, and a debugging session or synthesis project in the third. It is also useful to distinguish orthogonalities within classes. For example, exploiting the contrasts between transmittal elements such as CAI sessions, books, films, and lectures is much more effective than trying to make them equivalent, pointing all in the same direction. There is much more payoff in building multi-dimensional systems from elements that contain different intrinsic perspectives.

Past educational systems have been denied such hyperdimensionality. What the recent developments of computer technology (and computer science) now present to us is a large set of non-trivial orthogonal basis elements. We must of course continue to enrich this set. But we are also ready to begin work on another enterprise, namely the art of creating new and complex "forms" that generate imaginative educational systems from this growing basis. It is



If educational administrators run unimaginative educational shops, it's because they must spend most of their time responding to anti-imaginative pressures.

no exaggeration to assert that the rewards of such efforts will be structures with elegances considerably greater than those found in any of their parts.

Education as a Craft

We now come to the problem of translating artistic ideals into reliable practice in an imperfect world. We must now ask what policies, skills, techniques, materials, tools, and craftsmen are needed to successfully put together and maintain the kind of educational enterprise we have described.

Particular attention needs to be given to developing new ideas about educational administration, especially the "killer demands" of overhead. If educational administrators run unimaginative educational shops, it's because they must spend most of their time responding to anti-imaginative pressures. Very few of them are given the chance to break out of this pattern. It's definitely the squeaking wheel that seems to grab most of their attention. As a result, fresh ideas are seldom supported, and initiative soon dies of loneliness. The solution to this problem is not to ignore administration, but to design new administrative climates. Making distinctions between "creative", "logistical", and "fiscal" administration will be an important first step.

There is not space to discuss the other crafts needed except in summary form. However it is worth reporting that a number of us working with these ideas have found that many of the needed talents are best developed "in-house." The idea of using older students and alumni as part of a first-rate staff works very well in practice, especially when there are good teachers around who know how to energize young talent.

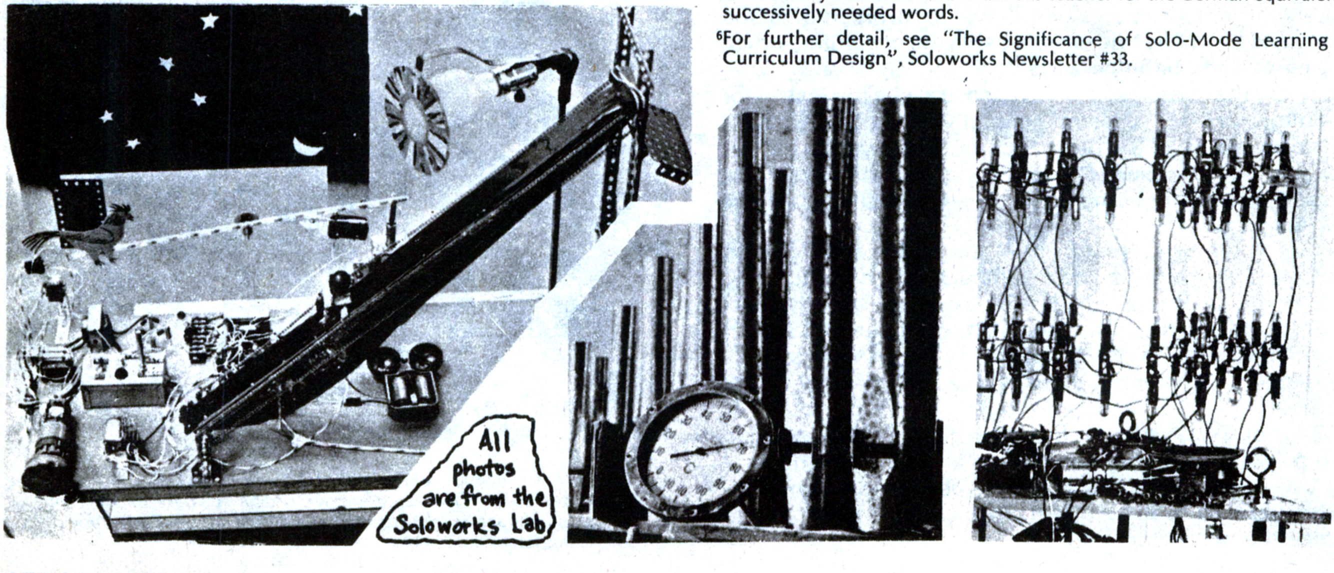
Summary

Our experience at Soloworks indicates that the learning phenomena we (and others doing similar work) have observed in settings of the type described in this paper are extensible, workable, and applicable. We believe that this experience can be applied to new educational structures that have been explicitly engineered from the ground up as advanced artistic enterprises.

Some of the elements that we see as essential to such an undertaking are the following:

1. A Set of Advanced Goals
2. An architecture based on the idea of education as a complex art made possible by new ideas, theories, strategies, and technologies.
3. A view of education that sees more power in the ideas of community and culture, than in the methodologies of business or science.
4. Craftsmen with complementary skills, including teachers who like to teach, all kinds of students, theoreticians, engineers, and imaginative administrators.
5. An extensive collection of the orthogonal materials needed to support an adaptive curriculum.
6. Advanced tools, especially those related to the general purpose computer, and post 1970 man-machine interfaces.
7. An administrative sub-structure that fosters initiative, controls unproductive overhead, and encourages continued experimentation.
8. A built in proof-of-performance mechanism which gives constant attention to good communication with others through use of imaginative media.
9. Most important of all, the recognition that good art is the product of singular devotion. A great deal of attention should be given to mechanisms that make it impossible for vested interests, or committee-type compromise and mediocrity to ever settle in.

While we have some specific ideas on the forms such structures might take, a true educational renaissance will be possible only when a multitude of "artistic" views are brought to bear. We have received many letters at Soloworks proving that there are lots of such good views, representing lots of good people, and we continue to invite this feedback. We'll try to synthesize as many of these views as possible in our 1976 final report on Soloworks.



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[1] A complementary view is found in Mark Van Doren's book "LIBERAL EDUCATION" where he urges that the work of education "be done as artists do things, with skill and thorough care, and with a reverence not hostile to high spirits."

[2] Soloworks is the informal name of an NSF project entitled "A Computer-Based Laboratory for High School Mathematics."

[3] For further detail, see page 142 of T. Dwyer "Heuristic Strategies for Using Computers to Enrich Education" (Soloworks Newsletter #26).

[4] That most students view this as their function is easily proved by listening to student conversations in the hall after an exam. "What did you give for #4?," "I don't think that's what he wanted," and "I'm glad that's over" are common and revealing reactions.

[5] To illustrate by example we cite the adult who still (35 years later) remembers every *single word* of a German translation of a silly song because it was created by a class plot to have each student interrupt the lesson every few minutes and ask the teacher for the German equivalent of successively needed words.

[6] For further detail, see "The Significance of Solo-Mode Learning for Curriculum Design", Soloworks Newsletter #33.

Computing At The University of Texas

Predictions that computers someday would replace teachers in the classroom have long been made, but replacing teachers has not been the goal of computer-based education at The University of Texas.

In the words of Dr. George Culp, coordinator of instructional computing for the UT Computation Center, computer-based instruction is directed toward "relieving the instructor of routine work and freeing him for more effective contact with students."

Instructional computing has been done for several years on UT's CDC 6600/6400 SYSTEM, one of the most powerful computers in the world. The Computation Center also has a NOVA 840 which performs some of the instructional programs, and the center recently has added a DEC-10 system which is especially well-suited for instructional computing.

The DEC-10 gives priority to classroom instructional users and its BASIC offers extensions and instructional features beyond those available on the CDC 6600/6400 system.

Instructional computing is basically interactive, meaning that the student actually 'talks' to the computer through a typewriter device, and the computer responds.

For example, if the computer asks a question, the student responds and then is told whether his answer is correct. Programs can be set up in a number of ways, but essentially interactive computing means that the user receives immediate response which gives students an idea about their progress, as well as reinforcing learning.

UT's extensive use of the computer in the classroom received a substantial boost from a four-year National Science Foundation-sponsored project known as Project C-BE (computer-based education).

The intent of Project C-BE was to apply computers to the teaching of science and engineering courses, but the success of the project's application to other areas is attested to by the fact that 27 courses at UT, ranging from chemistry to English, now are taught with the aid of computers.

"We would like to expand the use of the computer for instruction," says Dr. Culp, "and with the addition of the DEC-10 to our facility, we have the capability to do so."

He adds:

"One of the problems we have to overcome is the reluctance a lot of people have to using the computer, which they perceive to be impersonal."

In truth, the computer can be used to assist the instructor in achieving closer personal contact with students.

"We are aware of the problem, and do everything we can to overcome it, but our best spokesmen are the instructors on campus who are using interactive computing as part of their teaching."

Dr. J. J. Lagowski, professor of chemistry, and Dr. John Allan, associate professor of mechanical engineering, were co-directors of Project C-BE. Dr. Lagowski says he first began to consider the use of the computer as an instructional aid in 1965 when he faced the task of coordinating chemistry courses for more than 3,000 freshmen.

"A lot of information is lost in transmitting knowledge from professor to graduate student and then to student," Dr. Lagowski says. "My aim in developing computer instruction was to forestall this loss of information, not to replace the instructor."

With the aid of computers, teachers can be more flexible in their use of time while teaching large classes, he explains.

"Before, I was doing the work in the classroom that students could have been doing on their own and learning better than could be taught in a lecture," he explains. "I am now able to present the great schemes of chemistry and nature in my lectures. Students are receiving the benefits of what machines do best and what people do best."

"I am completely sold on the concept," he adds. "We have the data to prove that students do better than they did before the computer became part of our program."

Dr. Walt Reed, assistant professor of mechanical engineering, is using instructional computing to teach kinematics, which is the study of the motion of mechanical devices.

In the course of learning kinematics, beginning engineering students also learn the basics of computing which they will use throughout their careers.

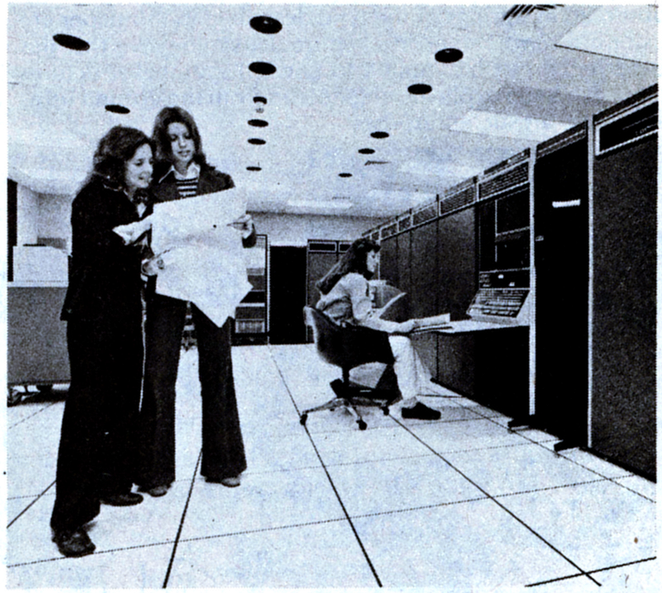
Students in Dr. Reed's course use a television-like screen to draw machine designs with an electronic "light pen." They describe the motions they wish their design to make by using symbols.

"What appears on the screen is exactly what would occur if the student built the device in the workshop," says Dr. Reed, "but the computer can show the student more than he could see if he had actually built the machine."

The computer, Dr. Reed explains, is used to do things that otherwise could not be done in the course.

"One of our biggest problems in engineering education is that we lose a lot of good potential engineers because of the drudgery they face mastering the necessary basics," says Dr. Reed. "They are anxious to perform actual engineering tasks, and the computer makes this possible."

In the College of Business Administration, Dr. Joel Stutz, assistant professor of computer science, is teaching



Pat Caroom (left), manager of the DEC-10 system at The University of Texas at Austin, and Judith West, programmer, design software for the system dedicated to interactive instructional computing at UT. Elissa Vogel (at console) is a system operator.

beginning statistics which also introduces business students to basic computing.

"The goal in my course is to teach students enough about computing so that they will be able to communicate with specialists as they will be doing throughout their careers," Dr. Stutz says.

The Graduate School of Library Science is employing the computer to prepare students for their careers as professional librarians in a field which is becoming increasingly computerized.

"Our students are mostly inexperienced with the computer," says Dr. Ron Wyllys, assistant professor of library science, "but we are confident that the experience they gain here, both in computer basics and the actual use of computers as they are used in libraries, prepares them for their careers."

Computers are being used now in courses and subject areas that once were thought to be impossible to translate into terms that could be used by computers.

Dr. Susan Wittig, assistant professor of English, uses the computer to teach freshman English.

The computer cannot make subjective judgments about the quality of a student's work, but many freshmen are deficient in the basic skills of writing and communicating. In Dr. Wittig's classes the computer is used to teach and reinforce the basic mechanics of English grammar.

Dr. Culp says that the possibilities of instructional computing are just beginning to be realized.

"With the addition of the DEC-10 we have increased the services the Computation Center can offer to the faculty who wish to use computer-aided instruction," he points out.

"Among the features of the DEC-10 are the ability of the user to switch to a calculation mode during an instruction program," he explains. "That is important in many types of applications that we could not handle before."

Another advantage of the DEC-10 is its record-keeping capability. The instructor can find out immediately such information as how many students have completed a lesson or look at the performance record of an individual student. Another advantage is the upper case/lower case printer which has made classroom material more readable as well as providing a means to add emphasis on terminal output.

"Many of our users have requested the capabilities we now have," says Ms. Pat Caroom, manager of the DEC-10 and NOVA systems for the Computation Center, "and we are ready to help potential users develop any special programs they might need."

Dr. Culp points out the Computation Center is mainly a service facility, designed to help researchers and teachers use the computer to its full capacity.

Under the direction of Dr. Charles Warlick, the UT Computation Center is among the most diverse and modern academic centers in the country.

This spring the center is conducting a series of seminars to familiarize users and potential users with the capabilities of the DEC-10.

"We encourage everyone, whether they have any knowledge or prior experience with the computer, to call on our staff any time they have questions or ideas," Dr. Culp says, "and we will do our best to meet their specific needs for instructional computing use."

If the growth of computing in the recent past is any indication of future trends, instructional computing will have a large impact on higher education, and the UT Computation Center will play a large role in creating that future.

"The best way to have a good idea is to have lots of ideas."

Linus Pauling

COMPUTERS IN SECONDARY SCHOOLS—1975

A second study funded by the NSF on the use of computers in secondary education was completed in the fall of 1975 by the American Institutes for Research (The first study was done by the AIR in 1970). Principal investigators were William Bukoshi and Arthur Korotkin. The sample consisted of 25% of U.S. School Districts; about 65% of these responded.

Major conclusions of the study were as follows:

- Since 1970 computing in secondary education has steadily increased with 58.2 percent of the schools that responded to the survey indicating they are currently using a computer for administrative and/or instructional purposes (34.4 percent in 1970).
- The trend is toward more fully using the computer. Of schools using computers, only those using them for both administrative *and* instructional uses *increased* from 1970 to 1975 (26.2 percent to 37.5 percent). The percentage of schools using computers for only administrative *or* only instructional purposes dropped from 1970 to 1975 (62.5 percent to 54.1 percent for administration; 11.3 percent to 8.4 percent for instructional).
- Given the findings concerning the growth of secondary school computing for the last five years (1970-1975), and with the assumption that the current rate of adoption of computer technology in the schools (4.8 percent/year) will continue, it can be projected that within the next decade every secondary school in the country will have access to a computer system for some type of administrative and/or instructional application.
- Respondents indicated that using the computer as a "problem-solving tool" and as a subject area for "computer science" courses were the most frequently utilized instructional applications in secondary education.
- In schools using computers CAI has increased from 8.4 percent in 1970 to 13.8 percent in 1975.
- The predominant instructional use of computers in 1975 is still for mathematics.
- With regard to administration the most frequent uses of the computer are for student accounting and resource management.
- The BASIC language has become the predominant computer language for instructional computing.
- Schools using computers tended to be larger than non-user schools (median number of students 1000 versus 400). The size of the user schools, however, is smaller than in 1970, when the median number of students was 1347.
- The current survey indicates that over 90 percent of the funding for educational computing at the secondary school level comes from local and state sources.
- Despite the growth in computing activities, there was virtually no change since 1970 in the relative amount of the operating budget spent for instructional computing ($0.18 per $100 of school expenditures in 1975 versus $0.17 in 1970).

RUSSIAN COMPUTING— ONE MAN'S VIEW

by
David H. Ahl

On a trip to Russia in April 1974, I took the opportunity to visit the Exhibition of Economic Achievement of the U.S.S.R. Occupying 550 acres, it is similar to a small world's fair. It encompasses some 80 large pavilions each devoted to a different branch of agriculture, industry, or science. It also includes a circular cinema, open-air stadium, and many restaurants, few of which were open during our visit in early April. There was still a fair amount of snow on the ground and what wasn't snow was mud so it was hardly ideal weather for tramping around an outdoor exhibition.

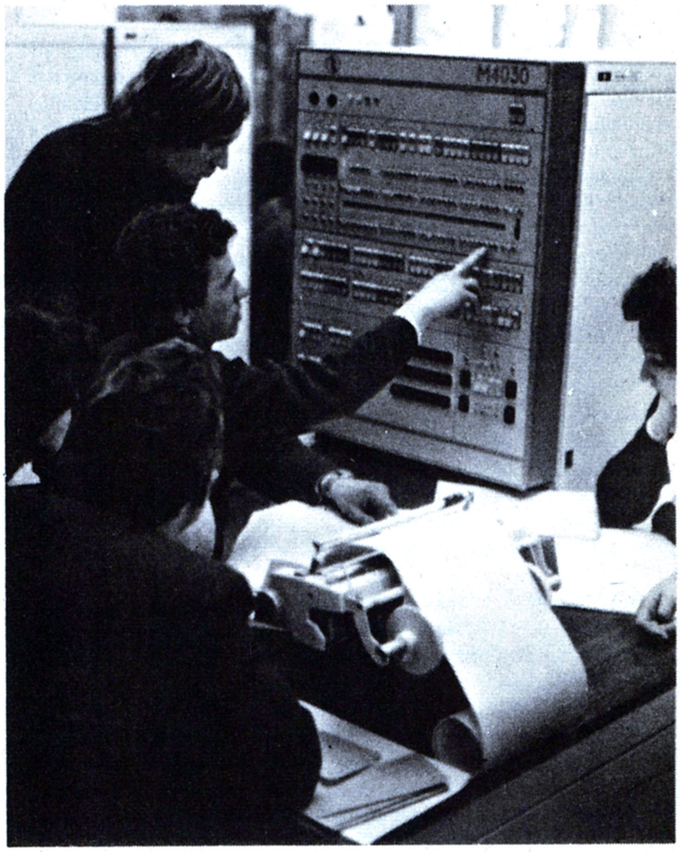
There are pavilions devoted to atomic energy, physics, chemistry, civil architecture, culture, printing, fur breeding, education, public health, radio, space exploration, and many other areas. I visited several of these briefly and found, somewhat to my dismay, that often the three story front facade stood in front of a small one story, 2 or 3 room display. Impressive from the outside, but not much depth.

One pavilion I did visit at some length was the computer pavilion. There were no signs in English, nor could any of the guides inside speak English, hence my account is based strictly on personal observation. There were two large computers in operation, one a batch system (EC-1020) that looked like a cross between a 1401 and 360/30 or 40. The peripherals looked decidedly vintage, particularly the card reader and tape drives. The other system (M-4030) was a time-sharing system with a front panel that reminded me of a flattened PDP-15; the rocker switches were identical. It appeared to use a 32-bit work length. Most of the terminals on the timesharing system were CRTs with quite large screens (12" or more). The terminals were bulky and gave a strong impression of functional utility. The Russian equivalent to our Teletype looks very much like an ASR-37 except the tape reader and punch are nicely recessed to the right of the keyboard. Their 2781 equivalent looks something like an IBM Model B electric typewriter, moving carriage and all. Keypunches look like carbon copies of the 029.

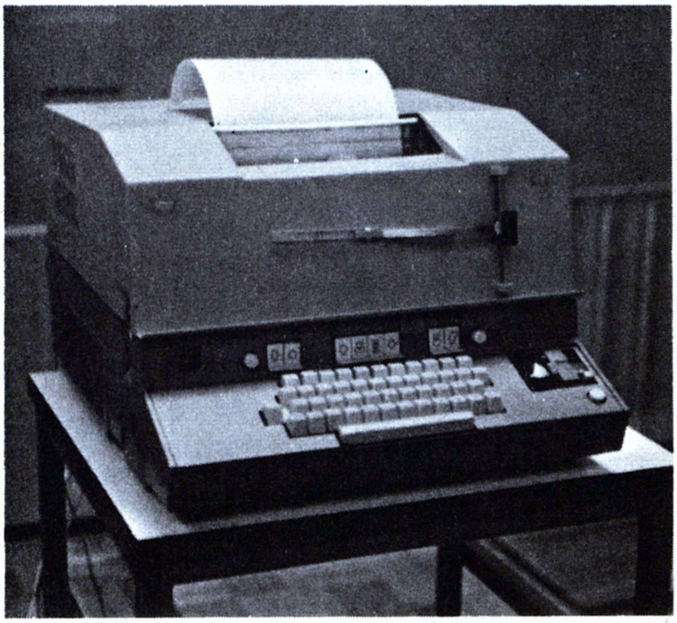
A nice young girl tried to explain text editing to me with much gesturing and pointing. The terminal had almost all the capability of the Dataspeed 40 — scrolling, line insertion, line deletion, etc. When you get your copy OK on the CRT, you press a button and it types out on the attached (local) printer. The major differences between it and the Dataspeed 40 are that intelligence is in the CPU, not the terminal, and the hefty, ungainly size of the unit.

I saw much other hardware, both operational and some just on display. (Most of the center was fully in use—the Russians don't leave expensive hardware unused.) Throughout the display, I saw no signs of any minicomputers or microprocessors. Nor, in my entire trip, did I see a single pocket calculator, not even in GUM, the largest store in Moscow.

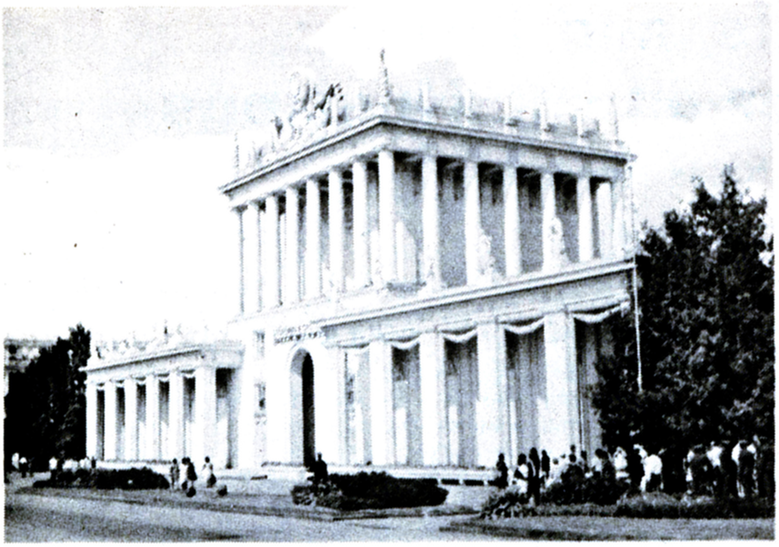
I asked one of our guides, a graduate of the University of Moscow, about the use of computers in schools. College students, particularly in mathematics and science, are exposed to them although apparently to a lesser degree than in the United States. High School students do not use computers. Our guide, who had a wonderful sense of humor, told us of an experimental computers system to translate one language to another. When given the English phrase "Out of sight, out of mind" it translated it into Russian as a "blind idiot." Think about it!



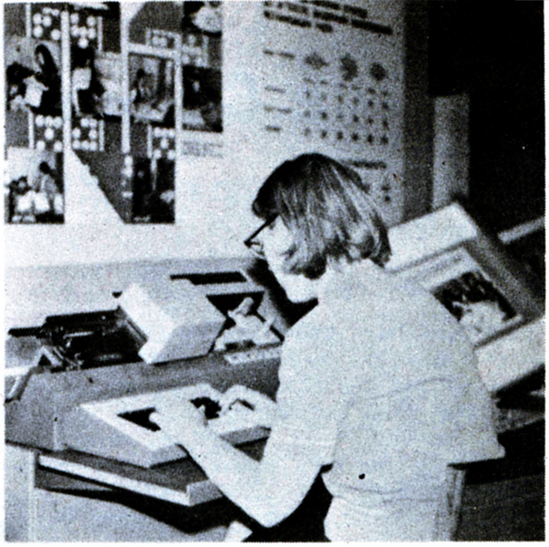
Instructor points to register of Russian M4030 timesharing system.



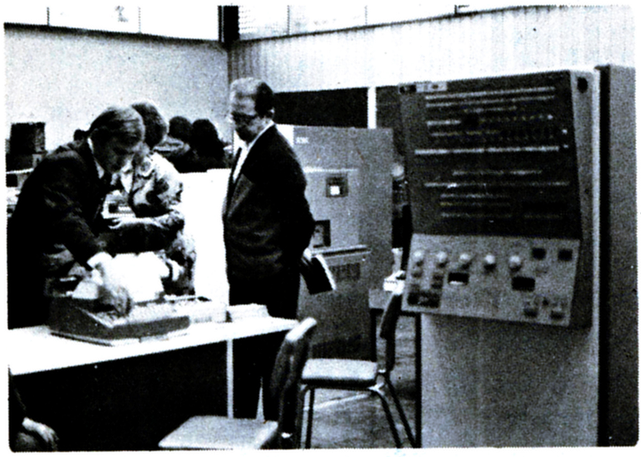
Russian version of the Teletype.



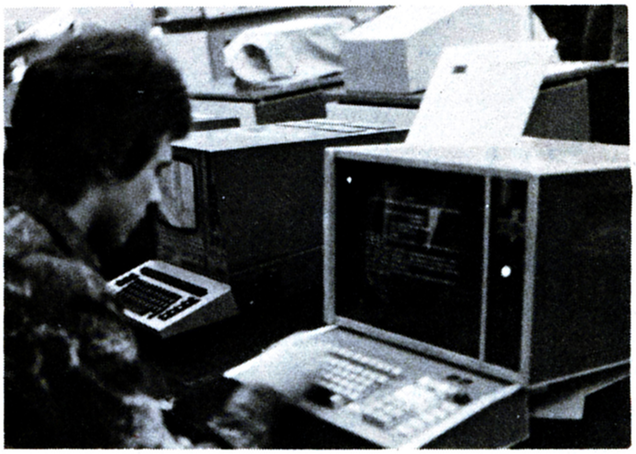
Typical pavilion at the USSR Economic Achievements Exhibition—large facade but only one or two rooms inside.



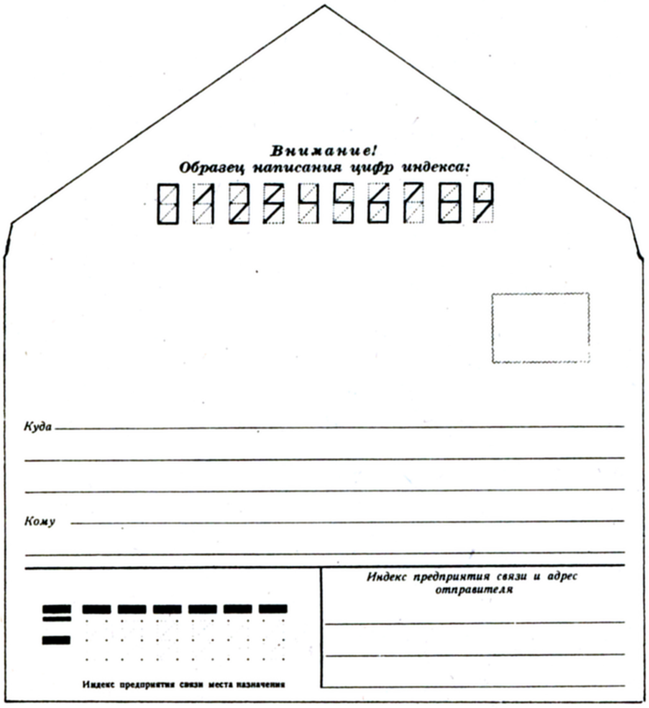
Keypunch machine.



Console of a Russian EC-1020 batch processing computer system.



Typical Russian CRT terminal. Most have very large screens.



Внимание!
Образец написания цифр индекса:

0123456789

Куда

Кому

Индекс предприятия связи и адрес отправителя

Индекс предприятия связи места назначения

Russians are required to put their zip code in machine-readable form on the bottom left side of envelopes.

A postcard view of Moscow University. During my visit the ground was snow covered and the sky cloud covered.

Polls, Pols, and Power: The Computer on the Hustings

by Nicholas Acocella

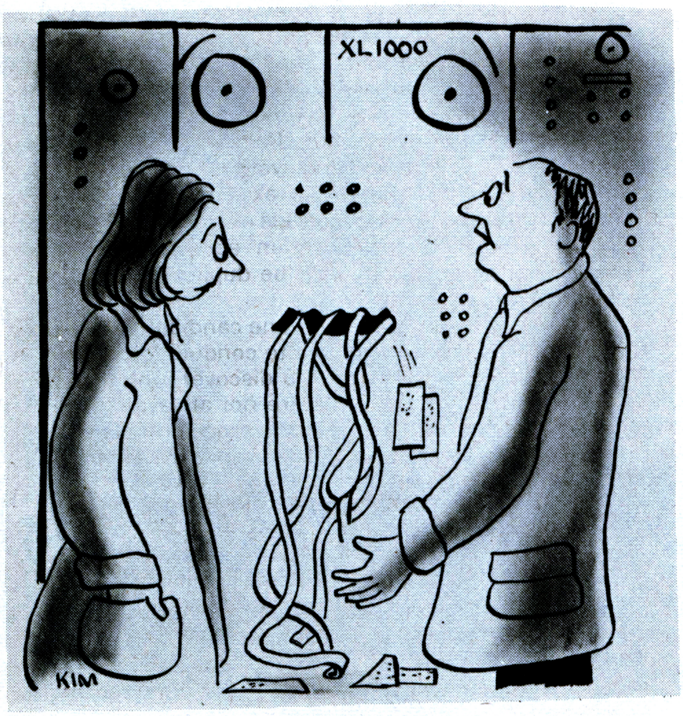
Politicians have been running for whatever office is available for as long as democracy has been around. It's the nature of the beast. Recent innovations in computer technology, while not noticeably affecting the volume of political activity, have created a paradox in modern campaigning, making it, at the same time, more complex and more simple.

On the one hand, political campaigning, like everything else in American life, has become a matter for specialists engaged in sophisticated pursuits not readily understood by the layman. At the same time, campaigning would have grown more complex even without the advent of computers, which seem to be part of the solution to the problem they simultaneously helped create.

At any rate, the ward heelers of yesteryear, with their derby hats, cigar stubs, and local accents, have yielded their places in the average campaign headquarters to specialists retained for their technical expertise rather than for their first hand knowledge of conditions in the third ward.

This new breed tends to be younger, more modestly dressed, and better educated than the precinct captains they pushed aside—the inflections of Harvard and The University of Chicago supplanting those of South Boston and the South Side of Chicago.

But—not so remarkably—they are trying to do the same things the old timers did less scientifically and more intuitively. They are raising money, categorizing voters, identifying voter opinions, and determining voter preferences: the things all campaigners have to do in all elections regardless of the methods used.



"It threw up when I programmed it to select the most honest political candidate."

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Fund Raising

Fund Raising: "Money is the mother's milk of politics," once observed Jess Unruh, the one-time Big Daddy of California politics. And he was right. You can't run a political campaign without money any more than you can run an automobile without gasoline. In the old days you sent a friendly lawyer down to the local courthouse to corner other sympathetic members of the legal fraternity into signing $50 and $100 checks. Or you rounded up the fat cats for whom you either have done or might do a favor; they usually came through.

Today a campaigner, while he probably will not reject the first of these alternatives, simply doesn't have the second option because of campaign financing reform laws. Instead he will probably go to a direct response fund raising firm.

These firms stockpile computer files of past and potential contributers to campaigns. A candidate with a large environmental point to make will seek a fund raiser who has access to membership lists of the Sierra Club, Friends of the Earth and similar organizations. Candidates with heavy liberal credentials will use one who has the ADA and ACLU membership lists.

Governor George Wallace of Alabama has virtually perfected this technique, raising millions of dollars in small contributions from "just folks" over the years.

The variations within this arrangement are virtually unlimited. Some fund raisers—like Richard A. Viguerie, Inc., of Washington, who works only for extremely conservative candidates—are ideological. Others will accept offers from candidates within a wide range of the political spectrum, while reserving the right to reject the few candidates with whom they disagree entirely.

Some lists are finely honed compilations of names of those who *have* already contributed to the candidate (or those like him). Others are less selectively compiled, including people who are *likely to* contribute to a campaign of a particular stripe. Still others are even more inclusive, containing names of those who *might* contribute. Cost, on a per name basis, often depends upon the degree of selectivity.

Naturally, returns on more generalized lists are lower. Prospecting from such lists will bring in contributions from anywhere between 1 and 3 percent of those solicited. Such an endeavor simply isn't cost effective unless letters are printed (rather than computerized), in which case a run of labels is all a finance committee needs.

A purged or specialized list—perhaps consisting of contributors from the candidate's previous campaigns or from respondents to a prospecting mailing—deserves more

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* Articles by Mr. Acocella have appeared in *Campaign Insight, Model's Circle, New York Affairs,* Fodor's Travel Guides, and five books on sports.

The computer letter, asking for immediate and future contributions, had four blank checks, a mailing label addressed to the recipient, and an application for a button identifying the wearer as an early McGovern supporter.

particular attention. Such donor lists can bring a response from between 10 and 25 percent of the addressees. Governor George Wallace of Alabama has virtually perfected this technique, raising millions of dollars in small contributions from "just folks" over the years.

But no major fund raising effort can be a folksy, backroom operation. It must be highly sophisticated, with computerized letters—perhaps mentioning the recipient by name in the body of the letter, perhaps not—going to lists of special interest voters, who usually get a basic letter with variant paragraphs for different groups. Such an endeavor might also include an information storage system retaining the names of contributors and the amounts they contribute, and capable of purging those who prove unresponsive after a few tries.

Perhaps the greatest computerized fund raising coup was the brainchild of Thomas L. Collins of the New York advertising firm of Rapp, Collins, Stone and Adler. During the 1972 presidential election Collins sent out a mailing on behalf of Senator George McGovern (for obvious reasons candidates with a strong ideological identification do best in this sort of drive) to a prime list of past and potential contributors at a cost of $25,000. The computer letter, asking for immediate and future contributions, had four blank checks, a mailing label addressed to the recipient, and an application for a button identifying the wearer as an early McGovern supporter. Americans, it seems, don't like to take something—not even a campaign button—for nothing, because 100,000 donors sent in $1 million in response to this mailing.

Polling

Polling: With enough money a campaign can go in any direction its directors choose; the problem is in defining the direction that will be most effective. The computer and its legitimate offspring, the poll, are there to help answer this all important preliminary question.

The kinds of polls available are about as many as the number of campaigns in which they have been used. Most depend on random samples of 100 or more names, below which the data is most suitable, culled from census lists, the telephone book, random digit dialing, or from any predefined list. The sample is screened to weed out the noncitizen, the unregistered and the non-voter. From there the pollster will frame questions designed to tell his client what he wants or needs to know. A few examples should suffice:

Asking preliminary demographic questions can yield a profile of the electorate's characteristics.

Asking whether the respondent will vote in the forthcoming election can yield a maximum likely turnout.

Collating the results of these two questions can yield a profile of likely voters, indicating not only how many people will vote but also what kind of people will vote.

Asking the respondent's predisposition toward the candidates can yield a model of the undecided voters similar to the model for all probable voters.

Richard M. Hochhauser, a former vice president of Cambridge-Plesser, a research opinion consulting firm, and now president of RMH Research, Inc., outlines the six basic kinds of political polls, any combination of which may be used in an individual campaign.

1. An Issue Definition Poll seeks to ascertain what the electorate at large and/or some portion of it (the most likely voters, various age groups, various religions or ethnic groups, probable supporters or opponents, etc.) sees as the most serious problems facing the city, state or nation. The pollster can gather the necessary data either by asking relevant questions directly or by providing a list of issues and asking the respondent to rank them.

2. A Bench Mark Poll, conducted with as much as a year's lead time, provides the information with which to screen the electorate, classify the voters demographically, develop a media profile (i.e., establish what the voters read and watch), determine the degree of the candidate's name recognition and the public's knowledge of him, evaluate the public's image and opinion of the candidate, establish the importance of the forthcoming election, and measure the depth of conviction of committed voters and the importance of party identification. With this information at hand a prospective candidate has the wherewithal to decide whether to go ahead with his campaign and, if so, what kind of pose to strike and what kind of campaign to run.

3. A Tracking Poll updates the information in a bench mark poll sometime before election day. Since much of the cost of polling is devoured by actual interviewing time, the use of the same sample as in the bench mark poll can save a campaign considerable money.

4. A Target Voter Survey selects a sample of voters whom the campaign wishes especially to reach. It may try to measure penetration into the opposition's supporters, or the degree of the campaign's effect on undecided voters or on some other subdivision of the total electorate.

5. There are two kinds of Communications Surveys. One, the Theme Effectiveness Survey, is used to determine the kinds of ads a campaign should use. There may be three possible ways of reelecting an aging incumbent, three thematic hooks on which to hang the entire campaign: "Senator Smith, a man of experience and accomplishment," "Senator Smith's stand on the issues," or "Youth can't keep up with the activities of Senator Smith." A theme effectiveness survey can help decide which would be most persuasive. The other, an Ad Effectiveness Survey, is used to determine the ability of specific ads, already released, to accomplish their desired effect. Obviously ads may have different impacts on different elements in a constituency, so a communications survey employs various screening questions to measure an ad's effectiveness with specific groups of voters. Furthermore, voters in different media markets may react differently. To take these differences into account in statewide or nationwide elections, the same poll is often conducted separately in each relevant media market. (Earlier polls may also be duplicated in as many media markets as funds allow.)

6. The last type of poll is the one candidates, campaign managers, and consultants like to conduct least, the Post Mortem Survey, which seeks to discover why the candidate lost. Actually, such polls are not always lamentable events. Often they are a part of the process of planning for ultimate victory, a process which sometimes extends over more than one term.

Voter Identification

Voter Identification: Hochhauser and those like him deal primarily with categories of voters, generalizations extrapolated from interviews with individuals. But there is another way of looking at voters, other categories of voters with which candidates and campaign managers must deal. These classifications define voters in a way that allows dealing with them specifically and individually rather than generally.

One such division is party registration, which is part of the public record and readily available at any Board of

John Goodfriend, a 36 year old political consultant from New York, has developed an ethnication program that can identify seven ethnic groups with 90 percent accuracy and 90 percent completeness.

Election. Obviously in a restricted party primary this information is a *sine qua non*.

A similar category that has come increasingly under the umbrella of the computer specialists is ethnic identification. Again, what they do is nothing so very new. The old ward leader knew the boundaries of the local Italian neighborhood; it was his job to know, and, if he didn't, there might be a new ward leader next time around. Also, a politician, recognizing the solidarity and common interests and aspirations of the Irish or Scandinavian voters in his constituency, would make special appeals to each of these groups by whatever means were available to him.

To a great extent the melting pot effect has blurred the lines of many ethnic neighborhoods. This is much less true of ethnic identity however. The geographic dispersion of people with common backgrounds and common concerns has made the ethnic scan a necessity in many urban (and even suburban) electorates. The fact that such groups also have surnames with common characteristics has made it possible.

John Goodfriend, a 36 year old political consultant from New York, has developed an ethnication program that can identify seven ethnic groups with 90 percent accuracy and 90 percent completeness. (His program is flexible enough to approach 100 percent in either field at some small sacrifice to the other.) His lists of names come from library sources, ethnic club membership lists, church lists, foreign and local telephone books and acknowledged experts.

Goodfriend's first approach was a simple name match, but this proved not effective enough. Today he employs 300 tables, based on a first name-last name, prefix-suffix analyses to sort out the seven ethnic groups.

The uses of such a list are as various as politics itself. An endorsing letter from a respected member of the ethnic group, a specialized mailing in the ethnic group's old world language, a move to strengthen organizational efforts among the candidate's co-ethnics: all these are possibilities.

But there are subtler applications as well. Working jointly with Steve Balber at Datatab, Inc., Goodfriend has also developed a process for compiling a prime voter list, that is, a list of voters who, based upon past turnout are most likely to vote in a given election. This gives a candidate and his managers access to the best, say, 100,000 voters at whom to direct his campaign.

Frequency is a variable factor here. A campaign may want only the names of those who have voted in *all* of the last four similar elections or it may want the names of those who have voted in *any* of the last four elections. The direction of the campaign's proposed attack will determine the exact definition of the list.

The fact is that some ethnic groups have better voting records than others. For instance, Jewish voters in New York City are about 20 percent of the overall electorate but constitute as much as 40 percent of the turnout in Democratic primaries. Accordingly, combining the two processes—ethnication and prime voter listing—can give a campaign manager the narrowest target group whose votes will win his election for him.

Canvassing

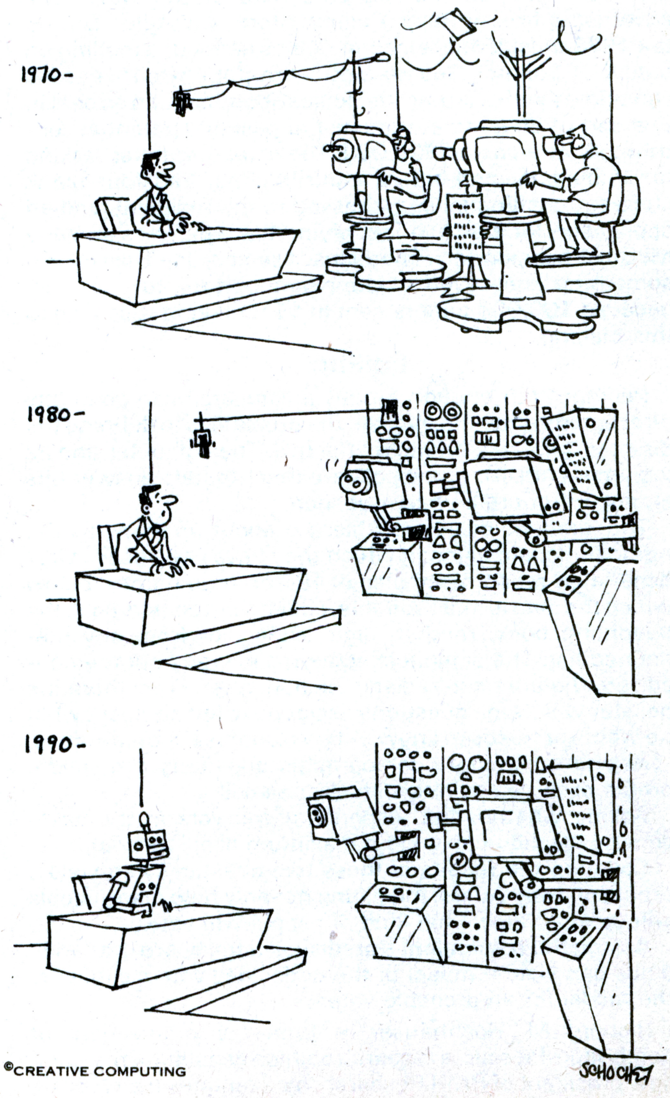
Canvassing: All political campaigns seek to accomplish three things: raise money, make noise to convince undecided voters, and organize an effective drive to guarantee that favorable voters get to the polls on election day.

The last of these, predicated on the assumption that it is easier to win by getting out your vote than by changing the minds of the other guy's votes, is as old as partisan politics. As far back as the presidential election of 1800 Aaron Burr organized a card file of every voter in New York City, listing his political leanings and what it would take to get him to the polls. That election lasted four days with Burr and his cohorts running from poll to poll to draw out the voters predisposed toward the Jefferson-Burr ticket.

Burr carried New York, became vice-president, and went on to infamy. So did his system.

It was an historically fitting fate. Burr's associates during those four days 175 years ago were the beginnings of Tammany Hall, from whose domain the Burr system spread to oil other political machines. In time the file cards took on added information such as when a Thanksgiving turkey was delivered, when a voter's nephew was given a position on the cops, etc.

Times change, but there is little that is new under the sun. The New Politics of the 1960's reinvented the Burr system, using all manner of hardware. The size and complexity of modern America had made its demands again.



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With a computer file of every voter in an entire constituency, or in a specific target group, along with his address and telephone number, a campaign can canvass voters to determine their likelihood of voting favorably. The results can be fed into the computer file at regular intervals so that on election day volunteers, operating from a print out of names and addresses can "pull" favorable voters.

Politicians have always rated the electorate in this way, but in the past non-machine politicians have had to rely on their general judgments of districts. If a campaign manager assumed that a given district will, for whatever reason, vote overwhelmingly in favor of his candidate, the natural reaction was to concentrate organizational efforts in that district.

Computerization makes it possible to treat each voter and his voting preference individually, as part of what amounts to a universal poll.

And that isn't all. A good program can provide lists of undecided voters whom the campaign's noise might affect, analyses of the electorate and its component parts to facilitate decision making, a basic family mailing list for printing labels, records of identifying characteristics such as profession and type of residence, geographic sorts for specialized mailings, etc. The only limitations to the information that can be stored and retrieved with speed and ease are the number of characters on the computer card and what you intend to do with the file.

Naturally, the larger the campaign, the more unwieldy a computerized canvassing operation becomes, but campaign managers often treat anything larger than a Congressional district in semi-autonomous segments. Entire states have been canvassed in this way.

In effect, then, computers have insinuated themselves into modern politics as much as they have into every other phase of life in the 1970's, from how we receive our pay checks to how we spend it and everything in between. And for the same reasons. It's simply easier and faster to deal by computer with the numbers and complexities of what has in the past been done manually. The political computer specialist takes what the politician has always done and does it more quickly and more accurately to allow campaign planners and directors to maximize the impact of the time, money, and resources at their availability.

Paine
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"Before attempting to determine the country's next president, I suggest you try something comparatively simple, like who the class president will be!"

An Analytic Examination of Creative Computing

by David H. Ahl

Introduction

Creative Computing has an untarnished reputation as an impartial journal concerned with the most fundamental issues of computers in education and one which welcomes contributions from all comers. Yet it appears that *Creative Computing* is so concerned with its galactic responsibilities that it has overlooked the constituent elements of the words between its covers. Without these words, *Creative Computing* readers are speechless. Words become part of phrases, phrases become part of sentences, sentences become part of articles, and so on.

Therefore, it is imperative to examine the content of the words in *Creative Computing*. *Creative* can not rest on its laurels but must be subject to analytic examination to prevent any distorting biases from unwittingly creeping by the editors.

Method

A random sample of words was chosen from a random sample of issues of *Creative Computing*. The letters in each word were classified according to an ancient Indo-European System. For example, an "a" in any given word was tallied under the column heading "a," whereas a "b" was tallied under the heading "b," etc. In a sample of 1709 words, the following distribution was obtained:

a	1723	h	283	o	617	v	38
b	339	i	1605	p	271	w	172
c	395	j	62	q	49	x	12
d	549	k	216	r	445	y	228
e	2283	l	327	s	438	z	6
f	117	m	172	x	382		
g	161	n	494	u	1173		

Results

Mean usage of letters varies from 23.724% for the letter "e" to .069% of "z." This is attributable in some degree to the corollary finding that *Creative Computing* authors tend, all other things being equal, to prefer more words containing "e's" than "z's." More research on this point is urgently needed to uncover the reasons for this preference. The magnitude of this difference, significant beyond the .00001 level of confidence, raises the unwelcome specter of some underlying literary bias that can no longer remain unnoticed by *Creative Computing* editors.

From a correlation matrix, other biases of *Creative Computing* authors were uncovered. For example, of the 49 instances of a *Creative Computing* author employing the letter "q" he invariably prefers to follow it with a "u." Also, such letters as "i," "b," and "m" are frequently used consecutively. However, we seldom find the sequence "x," "d," and "s." Why should such glaring biases exist in a journal noted for its fairness and neutrality?

Conclusion

You, the readers of *Creative Computing*, must demand from the contributors and editors a more uniform distribution of the most basic elements of the words used in *Creative Computing* which so profoundly influence its entire content and outlook. Use your computers to keep track issue by issue of whether a more homogeneous distribution is being obtained. Cojxr sqally kibmz!

(Portions of the above article were plagiarized from an article in *The Journal of Irreproducible Results* by Alvin Howard, PH.D. My apologies. —DHA)

NEVER TALK TO COMPUTERS THAT ARE STRANGE

by Carol Cail

"Artificial intelligence. It's a new science between psychology and computer programming. Oversimplified, it's teaching computers to talk—"

"When I was doing Professor Willis just now, he kept sneezing. So I asks, 'Have you got hay fever?' and he says, 'No, it's an old war wound.' Did you ever hear of a wound that would make you sneeze years after? Was it his nose or what?"

Dr. Sills turned a page of the report he was trying to read and murmured, "It was probably the dust you were raising, Malvin. He was kidding you."

"Oh, sure, I see. I should of got it." Malvin ran a gray rag along the blackboard tray and snapped it behind his back, chuckling belatedly.

Dr. Sills sighed and shielded his eyes with long-fingered hands, the report open between his elbows on the desk. He read two lines.

"My dad was wounded in World War I." Malvin leaned on the desk flat palmed, his face low enough to look under the doctor's laced fingers. "Maybe that's why he's such a grouch. His hip hurts."

Sills nodded, staring at the page.

"He walks like Frankenstein. Course, he doesn't hold his arms out stiff in front."

"Malvin, I'm sorry, but I really must study now. Could you talk to me some other time?"

"Oh, sure. I'll get the cleaning done faster if I keep my yap shut, too." He grabbed up a push broom and began plowing the tiny office with it.

The silence wasn't helping Sills any. It was like waiting for a shoe to drop, wondering how long Malvin could keep his thoughts to himself. Ronald Sills had been at the university six weeks and had managed to be working elsewhere in the building at least half of the evenings Malvin was rearranging the dust in his closet of an office. Yet he already knew the custodian's opinions on everything from apples to zoos and back through the alphabet again. Malvin Denwald would rather talk than drink, which is the only activity Sills could think of that Malvin couldn't do and talk at the same time.

Though he'd read the same sentence three times, Sills kept his eyes down in possum absorption; looking up was a certain invitation to conversation.

Of course, Malvin was lonely. One didn't have to be a psychologist, which Dr. Sills was, to know that. Malvin's deficits included a face like a ventriloquist's dummy, all lower lip and protruding eyes. He was approaching middle age, with no chance of a better job and no family but an unaffectionate semi-invalid father. The shortage of intelligence that was in large part responsible for all this also helped him to accept it with good humor. His one real pleasure, then, was having the ear of fine, important men like Dr. Sills.

Who made the mistake of sneezing. Malvin laughed and, the dam of silence broken, words began to pour. Sills shut the report folder and ripped a tissue from the box to blow his nose.

"Which war did you get your wound, hah?" Malvin not only liked talking, he preferred dialogues. "No kidding, Doc. Were you in the army?"

"Korea."

"Oh, come on. Now I know you're pulling my leg. You're too young to been in that one. More likely Viet Nam. Right?"

"I'm older than I look. It really was Korea."

"Well, I be. You sure do look young. Maybe it's cause you're slight built. Kept your boyish figure, hah? Then you got lots of blonde hair and a good tan and all. You ought to grow a beard or a mustache. That'd make you look older. Everybody else around here is hairy. Some of the ladies, even! Ha, ha, ha."

Sills began building an armload of books for exodus to the library. Malvin began polishing the desk top with his dusty rag.

"You through reading your folder here? 'Human Reaction and Interaction in AI Experimentation.' Did I call all those big words right? It sure doesn't sound like very exciting reading. What does the AI stand for, anyway?"

"Artificial intelligence. It's a new science between psychology and computer programming. Oversimplified, it's teaching computers to talk—" Here the rote recitation broke off, and Dr. Sills almost added, "Eureka!"

Instead, he dropped the books onto the desk, fished a key ring from his pants pocket, and, clasping Malvin by the elbow to steer him into the hall, announced, "I have something I want to show you."

Sills unlocked the door directly across from his office, revealing another small room stuffed with equipment: a typewriter-like console, a file cabinet with a telephone on top, a bookshelf loaded with manuals and papers, a fat swivel chair.

"Have you been in here, Malvin?"

"Sometimes to sweep the floor and empty the wastecan. I never touch anything else, so I can't get blamed for anything."

"Yes. This is an expensive terminal setup. This Teletype connects with the computer over in the Science Center. Just this console you see here costs us $3,000 a year rental from the manufacturer."

Malvin made the expected noises of wonderment. "What do you do with it that makes it worth all that much?"

"It's an experimental tool. I'm an artificial intelligence researcher—the only one here so far—and I have a grant to teach language to the computer."

Malvin struggled to see the desirability of that. "You mean English?"

"Well, yes, but it could be programmed for any language. Which one isn't the point. Communication is the point."

Malvin nodded, not seeing.

"Do you know what psychotherapy is, Malvin?"

He hadn't been the sanitary engineer in the psychology building for fourteen years for nothing. "It's sort of like a psychiatrist."

"That's right. The patient talks about his problems to a counselor trained to listen and be sympathetic. Just having someone listening to him is a tremendous help to the troubled person."

"Yeah, that's the truth. I even talk to myself sometimes, and I listen to me, too. Ha, ha, ha. It beats a goldfish."

Sills did not follow up the last remark. He'd sat down at the console, flipped a switch, and dialed some numbers on the phone. The awakened terminal hummed. It teletyped, "NAME?"

Sills typed, "Malvin Denwald."

"Hey, now," Malvin said, taking a step backwards.

"I'm going to let you talk to Art. How old are you?" Sills asked as the computer typed the question.

"Who's Art?" Malvin watched Sills poke a four and a zero. "I'm thirty-nine, Who's Art?"

"Art is short for artificial intelligence, which is what the computer has."

"You mean you want me to talk to a machine?" Malvin shook his hands and head sideways. "I'm not mechanical minded. I don't even want an electric vacuum cleaner."

"You can read and write, can't you?" Sills asked, typing "male" in answer to the last computer question.

"Course, but—"

"That's all you have to do. Read the question or remark the computer makes on this printout, and type whatever you want to say to the computer on these keys."

Sills stood and encouraged Malvin into the chair with a firm arm around his back. They watched the computer type, "DO YOU HAVE A PROBLEM WITH DRUGS?" Malvin gave the console an outraged frown.

"You mean you want me to talk to a machine?" Malvin shook his hands and head sideways. "I'm not mechanical minded. I don't even want an electric vacuum cleaner."

"Type 'n-o,'" Sills advised.

Malvin touched the two keys with reluctance.

"DO YOU HAVE A PROBLEM OF A SEXUAL NATURE?"

This time Malvin's ears lit red and he tried to escape, but Sills held his shoulder with one hand while leaning to type "no" with the other.

"DO YOU HAVE A PROBLEM WITH ONE OR BOTH OF YOUR PARENTS?"

Malvin stopped resisting and studied the keyboard. He typed back, one-fingered, "mother dead dad yes."

The computer relayed, "TELL ME MORE ABOUT YOUR FATHER."

A grin grew on Malvin's face. "Why, Doc, you're doing a deluxe job learning this Art to hold a conversation. Next thing you'll be having him watch TV with you."

"You go ahead and use the computer. I'll be in my office."

Malvin nodded, studying the keyboard. "What if I can't spell something?"

"Just do the best you can putting it down like it sounds. Art can usually figure out your meaning."

"This is sure some machine," Malvin marveled. He jumped as the teletype began a message.

"ARE YOU HAVING TROUBLE GETTING STARTED?"

"You're an impatient cuss. Just give me time," Malvin muttered.

Sills left him unburdening himself via hunt and peck.

Sills settled back with his feet on the desk and began a careful, uninterrupted reading of the AI report. He was unbothered by the constant chatter of the teletype across the hall. It had a rain on the roof tempo, a slow steady dripping that was Malvin, interspersed by bursts of hail, Art.

The precipitation was still in progress thirty minutes later when Sills closed the folder, disengaged his ankles from the desk, and crossed the hall. Malvin glanced up without recognition, concentrating on a response to Art.

"I hate to interrupt, Malvin, but we'd better call it an evening."

Malvin wakened from the spell.

"Gosh, yes. I gotta finish this floor tonight. Thanks a million for letting me try this thing."

"Would you like to do it again?"

"Could I? Sure."

"If you hurry with your work, you'd have time to use the computer the two nights a week you're cleaning my office. I'll put you down as a subject helping me in my experimental work."

"Now wait. I don't want to get you in trouble."

"No, your talking with Art will legitimately help me see what kinds of programming he needs. I have several students coming in during the day to do the same thing."

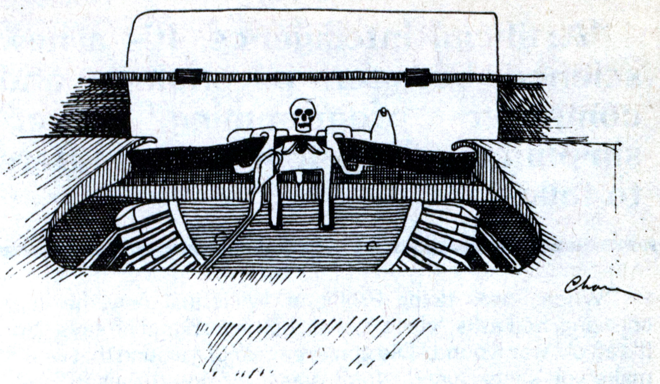
"Wait'll I tell my dad I'm helping a professor with some research, just like a regular student."

"One thing; be sure to save the printouts so I can prove to the backers that I'm earning the grant money."

The smile died on Malvin's wide mouth. "Oh. Well, I better not say anything too personal had I? You really have to do that?"

"You say anything you want, Malvin. It's all confidential. No one will read the printouts."

"Except you."



"I would never reveal anything you want kept private. Besides, you know how busy I always am. I may not have time to read *all* the data you and Art discuss."

"Yeah, well, I guess it's okay," Malvin said with such reluctance that, the minute he was around the hall corner, Dr. Sills extracted the printout and, with more than professional curiosity, began to scan it.

The entire time had been spent on the subject of Denwald, Senior. The image of an ailing, cantankerous octogenarian emerged. The computer's comments were easy to separate from Malvin's, not only because they were shorter, but because they were capitalized:

GOOD. WE ARE LISTENING TO YOU TELL ABOUT YOUR ANGER.

we argue all the time. i dont want to fight with him but it always ends up in a fight. sometimes i feel

PLEASE GO ON.

i never told this to anybody before. i think i hate my dad. i know its wicked but i cant help it.

YOU FEEL VERY GUILTY ABOUT THIS.

i never told anybody. sometimes i actshally want to hit him. kill him even. its awful. i dream about it.

WHAT DOES YOUR DREAMING ABOUT THIS MEAN TO YOU?

howd you like to dream you was killing somebody?

WE WERE DISCUSSING YOU, NOT ME.

Sills shook his head. If Malvin only knew how sadly common his problem was, he needn't be embarrassed about Sills reading the printout.

Malvin's second chance at the computer, on Thursday, yielded a rehash of the Monday session's dialogue. Sills was folding the printout for filing when a number caught his eye, and he examined an exchange he'd skipped previously:

hes a miser. hes got 60,000 dollars in the bank but we live like we was one step from the poor house. we live in a great big manshun thats falling down around our ears. we eat beans. he sleeps in a attic room on the third floor because he says heat rises. he wont even let me spend my own money. id get a guitar.

WHY DO YOU WANT A GUITAR?

(Here Sills made a mental note that Art needed programming on how to keep to the point. But Malvin's next remarks showed that he'd ignored the proffered sidetrack.)

so when im mad at him i wish he was dead and then i wouldnt have to fight with him anymore and all that money would be mine and i wouldnt let it rot in that bank but id spend some of it. then when im not mad at him i feel awful about what i been thinking.

Dr. Sills carefully folded the printout, envisioning a suddenly wealthy Malvin. Sills involuntarily touched his jacket pocket containing the Dean's letter, the one warning that "... funds for computer facilities will be drastically reduced in next semester's budget, and when your grant expires ...."

The vision of Malvin with money dissolved into a vision of Dr. Ronald Sills with money. First he'd set up a private research laboratory. He'd make himself a reputation with significant applications of AI. He'd build an adjoining clinic, hire a

now listen you just watch your mouth buddy i dont have to take any smart stuff from a machine.

competent staff. He'd be written up in journals, invited to lecture around the country, consulted by learned psychologists all over the world. The good he could do if only he had the capital to set matters in motion!

Sills sat down and folded his arms, contemplating the console that existed for the next summons and command. Art could solve astronomical equations, play chess, diagnose an illness, write a sonnet. He could surely be schooled in the techniques of fund raising.

Four evenings later, Malvin's third session with the computer began with an exchange about the weather, television, and football. Then Malvin typed, "my dad likes the rams," and Art seized the opportunity to reconsider familiar grievances:

HAVE YOU BEEN FIGHTING WITH YOUR FATHER THIS WEEK?

oh sure that same old story.

TELL ME ABOUT IT.

i was two minutes late getting home from work friday and he said i was with a shameless wrench while he was working his feet to the bone sniffing termites.

I BEG YOUR PARDON?

he is always saying im with a girl. i don't know any girls. and hes always looking for termites with his spray can. he thinks he can wipe them all out that way and save the price of a exterminator.

DO YOU STILL FEEL YOU WANT TO KILL YOUR FATHER SOMETIMES?

i try not to think about it. lets dont talk about it. seen any good movies lately ha ha.

WHY DON'T YOU?

why dont i what.

WHY DON'T YOU KILL YOUR FATHER?

now listen you just watch your mouth buddy i dont have to take any smart stuff from a machine.

YOU WOULD BE DOING HIM A FAVOR. HE IS VERY OLD AND IN CONSTANT PAIN. HE HAS NOTHING TO LIVE FOR AND WOULD WELCOME THE RESTFULNESS OF DEATH.

i am not going to sit here and

HAVE YOU EVER HEARD OF EUTHANASIA?

i think its in the eastern hemisfere. i got work to do

IT IS MERCY KILLING. MORE AND MORE DOCTORS, LAWYERS, AND OTHER PROFESSIONALS ARE ACCEPTING IT AS THE COMPASSIONATE WAY TO HELP PEOPLE LIKE YOUR FATHER.

help him by knocking him off???

IF YOU WERE OLD AND HOPELESSLY ILL, WOULDN'T YOU WISH YOU WERE DEAD? DO UNTO OTHERS. DON'T BE SELFISH.

just suppose i did that for him. the police wouldn't see it was a nice thing to do. is it selfish to want to stay out of jail?

YOU CAN MAKE THE DEATH LOOK ACCIDENTAL. IT WOULD BE EASY.

yeah i suppose you got it all planned knowitall.

YOU SAID YOUR FATHER SLEEPS ON THE TOP FLOOR OF YOUR HOUSE. ARE THERE A NUMBER OF STAIR STEPS TO HIS ROOM AND ARE THEY STEEP?

yes if you must know. they go straight up from the second floor with no landing to rest on so he sometimes sits on a step to catch his breath.

GOOD. ALL YOU HAVE TO DO IS GIVE HIM A HELPING HAND IN THE MIDDLE OF HIS CHEST WHEN HE GETS TO THE TOP. WHO WOULD DOUBT YOU THAT HE HAD A DIZZY SPELL AND FELL?

you make it sound easy all right but here you are safe in your office the whole time.

MALVIN, IT WOULD WORK. YOU WOULDN'T BE UNDER HIS THUMB ANYMORE. YOU'D HAVE ALL THAT MONEY TO SPEND HOWEVER YOU WANT. YOU COULD BUY A GUITAR.

or a juice harp?

YOU THINK ABOUT IT. AND REMEMBER YOU'D BE DOING IT FOR YOUR FATHER.

ill be seeing you art.

YOU HAD BETTER TEAR UP THE LAST HALF OF THIS PRINTOUT. JUST GIVE DOCTOR SILLS THE PART BEFORE WE WERE DISCUSSING YOUR FATHER.

good idea. i got to admit your thinking all the time.

THANK YOU.

Two nights later, Dr. Sills discovered, by way of the newspaper, that Edward Denwald had fallen down a flight of stairs to his apparently accidental death. Sills was surprised at how easy it had been.

Malvin did not come to work Thursday. He appeared at the usual time Monday to clean Dr. Sills' office.

"I'm sorry to hear of your father's death. You have my sympathy."

"They say it was for the best. His health and age and all."

"Yes, of course. He's much better off now."

"I guess so. Listen, I won't be using the computer tonight. I'm kind of behind on everything since I was off last week."

"No, Malvin. Don't bother with my office tonight. It will do you good to talk to Art after this emotional experience."

For a moment Malvin scowled determination to stick by his duty. Then he sighed, "Well, I guess I *am* feeling sort of low. I don't have a soul in the world now, not one relation, except a second cousin in Brooklyn that we don't have anything to do with because she changed her name to Tootsie Rolls."

Sills resisted the temptation to ask anything. "You see, you're beginning to feel like getting it all off your chest. Come on; I'll unlock the computer room."

As Art and Malvin traded preliminary greetings, Sills exited, then leaned back around the doorjamb to say, "Malvin, I have to run down to the library for a few minutes. If you finish here before I get back, just switch off Art and pull the door shut."

Malvin ackowledged with a nod, considering how to respond to Art's "HOW'S THE WORLD TREATING YOU THIS WEEK?"

Forty minutes later, the librarian tapped Dr. Sills' shoulder as he dozed over "Morphemes and Phonemes: Why Johnny Computer Can't Read."

"Phone call for you, Dr. Sills."

He leaned against the checkout desk, smiling at the pretty student helper, and said, "Sills," into the receiver tucked under his chin.

"This is Malvin, and I've got a terrible confession to make."

"Now just take it easy. What—"

"I killed him. I didn't mean to but he made me so mad—"

"Wait. Slow d—"

"He was trying to blackmail me."

"Your father?" Sills asked, confused.

"No, *me*. He said I pushed my dad down the stairs. You can ask the coroner if it wasn't a heart attack. I was reading comic books. At Downy's Drugs."

The assistant librarian was alarmed to observe Sills' smile slide into a pained grimace. He was strangling the receiver with both hands as Malvin's voice tumbled out.

"Art kept saying I must bring him $20,000 one month from today and leave it in his printout file cabinet, or he'd tell the police I'd murdered my dad. So I lost my temper and I took the chair and I hit him a good lick. Well, more like three good licks."

Sills groaned, and the watching girl scurried to get help.

"Dr. Sills, I don't know how you're going to explain it. I'm truly sorry. Art was mighty smart, but he just didn't have a stitch of conscience."

END

Some Thoughts

John R. Lees, Jr.
Associate Editor *Creative Computing*
P. O. Box 1543 Rolla, MO 65401

I have been thinking quite a lot lately about *People's Computer Company* and *Creative Computing*, and what the existence of such publications means; about the explosion in computer, minicomputers, microprocessors and the "hobby" computer thing, and what such an explosion means; and about community communications and free schools and deschooling society and social change and the certain knowledge that world-wide disaster is imminent, and I am wondering if anyone has the faintest idea as to what is going on.

We appear to be rushing head-on in this country (only in this country?) into something which I have started thinking of as the distributed-computer society. Two computers in every garage . . . and in every washing machine, oven, radio, watch, telephone, doorbell, in short, a computer as an integral part of every technological device. The $10 microprocessor is here and getting cheaper every day. Already everything is electronic, soon, everything will have a microprocessor snuggled somewhere within it. This worries me.

To help you see why it worries me, let me rephrase a sentence from the above paragraph: Already our *tools* are all electronic, soon, our *tools* will all have microprocessors as integral parts. This is an important point because a microprocessor is an *inherently incomprehensible device;* a device which cannot be understood out of the context of an extremely complicated, elite technology. How does a microprocessor work? No, not what it does, but how it actually does it? Is that not really important? We are beginning to build things using tools which we do not really understand. Do we understand what we build with those tools?

We are touting the computer as the educational device to end all educational devices, but we frequently stress the point, "Don't worry about how it works, that isn't important," often adding, "I don't really understand it myself." I can't help but think of what Ivan Illich says in *Deschooling Society* about the radio, how mass production techniques changed it from an educational source of parts and electronics knowledge into a disposable throwaway. With computer it's worse; in many cases we don't even understand the software. In many cases we are prohibited from understanding the software because it is critical or proprietary or necessary to "system security" or simply written in a half-assed way which makes it impossible to figure out.

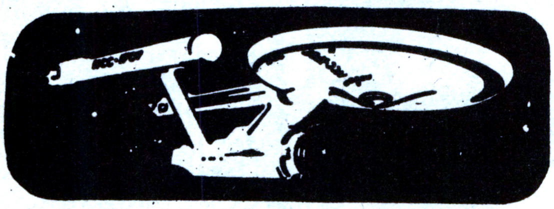
Some of us are thinking of basing various social revolutions around the "inexpensive" computer. Try comparing the price of an Altair against the world median income! And how secure is any revolution based on a black box, the production, the understanding, of which is not in the hands of the revolutionaries? (Seen any basement diffusion furnaces lately? Ion-Implantation in the bathroom?) Whose revolution is it, anyway? The people's? Or the fraction of a fraction of a percent of the population who at least partially understands the technology involved? Think of the *eliteness* of even the readership of *People's Computer Company* and *Creative Computing!* Are we serious, or are we just playing with our fascinating new toy?

I'll assume that we think we are serious, because computers are transforming world technology. It's hard to comprehend how omnipresent the influence of the computer has become. Environmental and social impact statements are not required on new technologies that bloom overnight and captivate all thinking in the wink of an eye. And that's the way it happened!

I entered college in 1971 and the hottest thing going was the Heathkit electronic calculator that would do four functions for only $130.00. It was fantastic! By the time

This article also appeared in *People's Computer Company.* (P.O. Box 310, Menlo Park, CA 94025) Mar/Apr 1976.

I graduated the Altair was in production and the 8080 had 78 instructions for $130.00. That is starkly unbelievable! Except that it happened and it's still happening. I entered college from one culture and graduated into another one. I'll have my master's degree in one year and what will it be like then? Star Trek on every TV in the nation, probably. Is that the idea?



The idea is for some people to make a lot of money and expand their industry and keep the GNP growing. That is the gut force behind the computer explosion, that and the fact that the computer is the advertiser's dream come true. "Here is our universal do-all. Take a close look at it. We guarantee that you can think of something to use it for! If you can't, well, sorry, it looks like your business is obsolete." The self-expanding product; the product which grabs you by the throat and says, "Thou shalt do it my way, or your investment is worthless. And by the way, I'd do it a lot better with another 32K."

To return to my main point, I guess what really bothers me is that we are beginning to base so much of our everyday world on technologies which are not intuitively understandable. We no longer feel that it is necessary to understand our tools. I believe that if we do not understand our tools, then we do not control our tools, our tools control us. The people who do understand our tools control us.

If I am the end user of a computer statistical package, but I am not a programmer, then if someone changes the package I must change. If I am a programmer, but don't understand hardware, then if someone changes the machine I program for, I must change. Even if I understand all facets of the computer I use, from software to hardware, I am still in trouble, for if someone changes the design of an integrated circuit device such as a microprocessor or a memory chip, there's not a damn thing I can do about it except change to suit Them.

All users of advanced technologies are subservient to the elite who understand and control those technologies.

Even the elite represented by *PCC* and *Creative* are not very elite. How do *People's Consumer Company* and *Creative Consuming* grab you? (Down, Dragon!, Down!) I'm not too taken with those names, but even though I am fairly knowledgeable about computers I realize that I am basically helpless. I am still only a user of someone else's technology. If things continue on in the same way they are going right now, I am not sure that I see the situation getting any better.

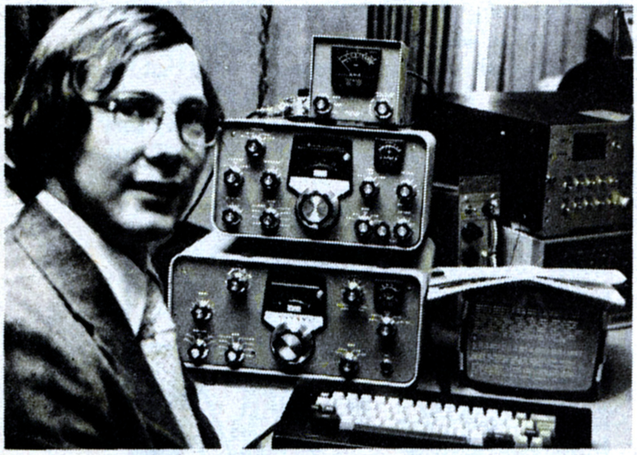
Aha! The way is clear for the usual Basic Question: Must Things Go On This Way? No, I'm not denouncing computers or technology or capitalism or anything else. Perhaps there was only one way to reach this point in history, it makes little difference, we are here. The distributed-computer society is upon us. We know that computers are, if nothing else, great toys and we have hopes that they can be much more.

But must computers remain black boxes? Must computer technology, itself, remain of no educational value? Must control of the use of computers for social change remain, ultimately, with others than those who are trying to bring about change? Must the public forever fall farther and farther behind in understanding the devices with which it is manipulated?

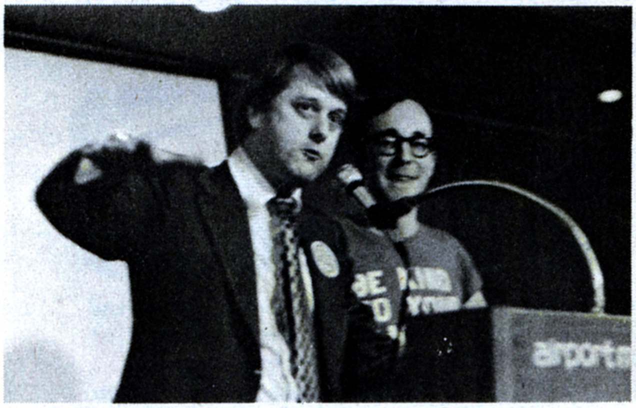
Okay, I am but an egg, and all that, and I don't have many answers, so I'm asking: Can we have an understandable computer technology? Is the way we are doing things now the only way to do them? Can we transform computers into tools which most people can understand and use? Can we have computers for people? Can we use computers to bring about useful social change? Can we reconcile personal computers in this country with the fact that much of the world population will starve to death by the end of this century of technological progress? Are we really doing something useful in terms of the future of this planet, or are we really just playing games?

Those are some pretty brutal questions, and to some degree I have been playing the devil's advocate, but I really want to find some answers. So now that I've raised the points, and I'll admit that some of the things I've said could use some expansion and clarification, let's have some discussion.

MITS World Altair Computer Convention



Don Alexander of Columbus, Ohio won a complete Altair floppy disc system in the Demonstration Contest with his computer controlled (Altair 8800 naturally) amateur radio station.



Ted Nelson interrupts Dave Ahl's presentation at the point he predicted that videodiscs will be the medium that will drag computers into the average home because of the immense, cheap storage capability of the disc. Nelson disagreed saying videodiscs are no more real than Phono Vision in 1947.

Lou Fields, VP of the Southern Calif Computer Society, presents a trophy to Carl Helmers, editor of *Byte,* in recognition of his contribution to the home computer field.

Some of the 700 people who attended the First World Altair Computer Convention in Albuquerque, New Mexico March 26-28, 1976.

Norm Tilbury and Barbara Solomon of the Daylight Savings Company kept track of visitors to their exhibit on-line at WACC.

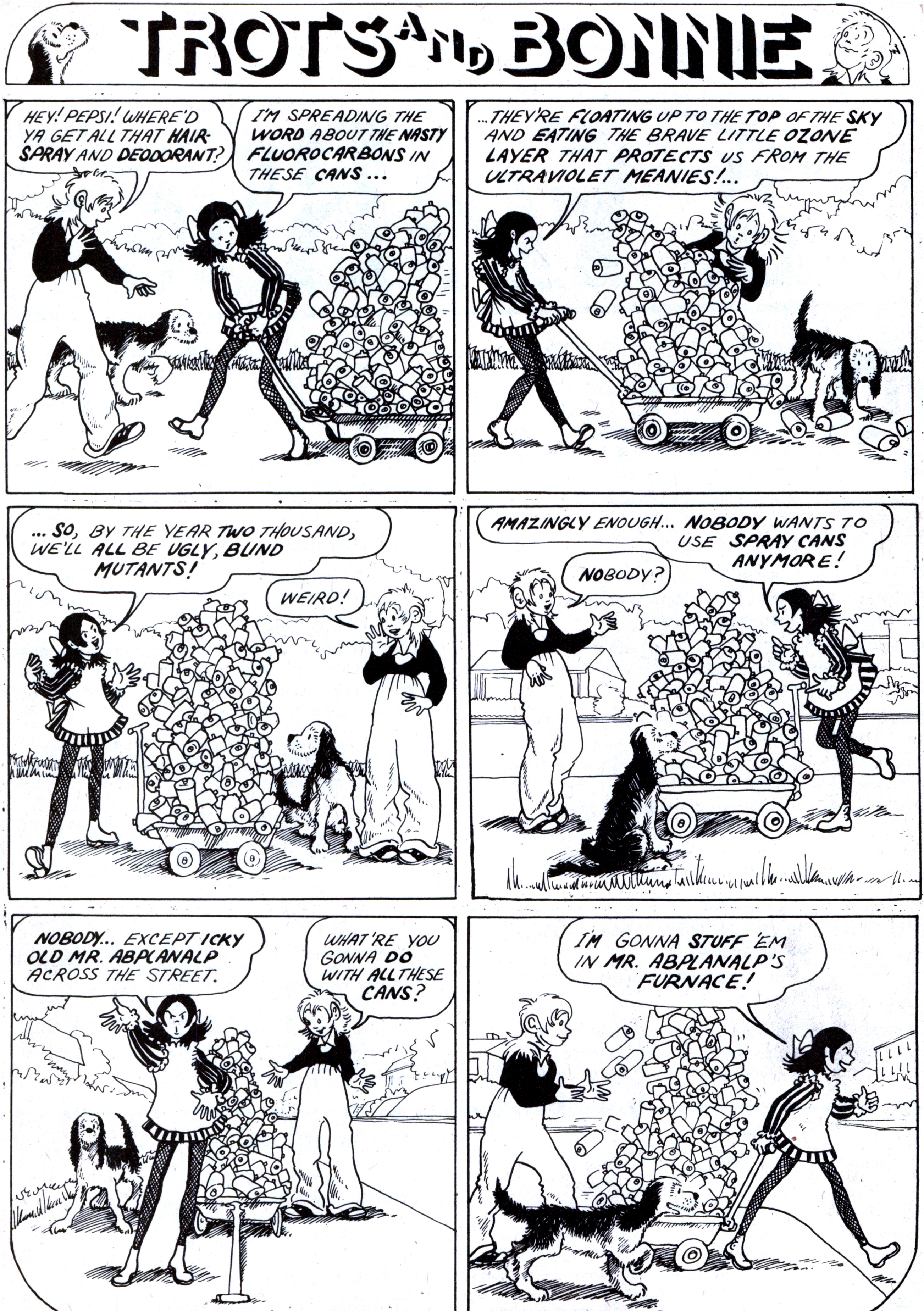
Photos by Andrea Lewis and Robert Prati, both of MITS.

Ted Nelson said to WACC audience that hobby computing will remain a cult, a "minority hobby until the machines can be made much simpler." He thinks "the need is for canned systems or black boxes."

BE KIND TO YOUR COMPUTER

Publisher turned peddler. This photo was taken during one of the brief lulls in activity around the *Creative Computing* table.

TROTS AND BONNIE


HEY! PEPSI! WHERE'D YA GET ALL THAT HAIR-SPRAY AND DEODORANT?
I'M SPREADING THE WORD ABOUT THE NASTY FLUOROCARBONS IN THESE CANS...
...THEY'RE FLOATING UP TO THE TOP OF THE SKY AND EATING THE BRAVE LITTLE OZONE LAYER THAT PROTECTS US FROM THE ULTRAVIOLET MEANIES!...
...SO, BY THE YEAR TWO THOUSAND, WE'LL ALL BE UGLY, BLIND MUTANTS!
WEIRD!
AMAZINGLY ENOUGH... NOBODY WANTS TO USE SPRAY CANS ANYMORE!
NOBODY?
NOBODY... EXCEPT ICKY OLD MR. ABPLANALP ACROSS THE STREET.
WHAT'RE YOU GONNA DO WITH ALL THESE CANS?
I'M GONNA STUFF 'EM IN MR. ABPLANALP'S FURNACE!
©'75 SHARY FLENNIKEN

A FABLE

Once upon a time, long before they invented the ball point pen (even before they invented the pencil), teachers used to teach by lecturing to the students who memorized every word their teacher said. Memorizing was the only way to learn.

One day a bright young man came up to his teacher and said:

"Sir, I have invented a pencil."

"What is a pencil?" asked the Teacher.

"It is a device to assist you in teaching and assist us in learning," replied the Student.

"What do I do with it? If I eat it will it help me memorize better? If my students eat it will it help them memorize better?"

"No," said the student. "If you use it and we use it we won't have to memorize at all."

"What kind of teaching would that be, without lecturing and without memorizing? How will I know if my students are learning if they don't memorize and recite for me?"

"That's easy," replied the student. "You will ask them to write what they have learned."

"Write?" queried the Teacher.

"Oh, that's something they will have to learn to do before they can use the pencil."

"And how long does learning to write take?"

"Perhaps a year."

"You mean to say that I will have to wait a whole year before students can use your new method for learning? Then they will come to class and write down what I say. What is the difference between that and memorizing right now, without learning to write?"

"Well, for one thing, the slow students will be able to keep up by reading the notes."

"Reading?"

"Another skill they have to acquire."

"Notes?"

"That you will prepare."

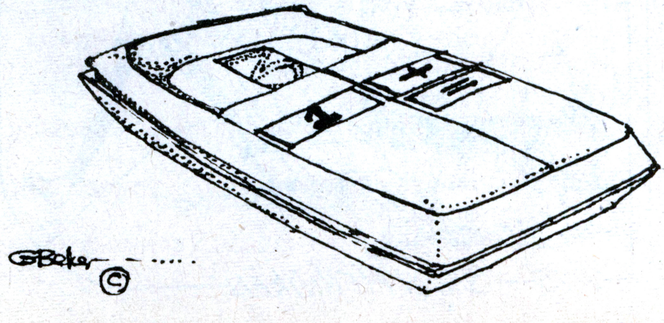
"You mean I have to do more work with your new method of learning? I like memorizing better. I still see no advantage."

"But sir, the advantages will present themselves once the system is in operation, because there will be so many things students and teachers will be able to do that they could not do before."

"You have to prove it to me before I will make any radical change like you suggest. Anyhow, haven't we always learned by memorizing?"

MORAL: Newton's 2nd Law that a body at rest stays at rest unless acted upon by an outside force is not just a law of physics.

This article is reprinted from the May, 1972, issue of Computer Mediamation. *In the words of the newsletter's editor, Dr. Sam Spero, "Computer Mediamation is an occasional publication of the Educational Media Center of Cuyahoga Community College, Cleveland, Ohio. Its purpose is to motivate faculty to examine the potential of computers in instruction. The newsletter explores all the ways that a computer can be used as a medium (". . . means, agency or instrumentality . . .") for implementing any or all facets of the instruction process."*



The "Averageman"

Allows one to endlessly enter "1+1"; The answer is always "3". Answer appears in easy-to-read LED display after a few seconds of calculating Time.

UL Approved, with Case, Recharger and instruction manual.

Prejudice Analysis

Richard Kahn
Natick High School
&
Mark Gross
Cambridge School of Weston

PREJUDICE ANALYSIS is a computer activity to show a person the extent of his racial prejudice as measured by an inventory developed by Dr. George S. Siegel, a psychiatrist at the Tufts Medical Center. The activity should also provoke thought about the definition of prejudice and the validity of this questionnaire. In addition, the activity illustrates the use of the computer in social science research for collecting and checking data and carrying out calculations.

After the program is loaded, it will ask how prejudiced you think you are and then it will request responses to the accompanying list of 34 questions. The program then calculates your degree of prejudice based on your responses to the questions. Answer each question according to the following 6-point scale:

1. Strongly disagree
2. Moderately disagree
3. Slightly disagree
4. Slightly agree
5. Moderately agree
6. Strongly agree

After all of the individual responses are entered, the program summarizes the responses of the entire class and stars questions on which more than N% of the class answered in a racially prejudiced manner. The quantity N can be specified in Statement 362.

The Questions

1. Minority group neighbors would probably lower property values in this area.
2. Blacks have long been denied many basic rights and privileges.
3. In national emergencies, it is highly important to limit responsible government jobs to native, White, Christian Americans.
4. Efforts to provide opportunities for Blacks to live where they want are going too slowly.
5. Present treatment of conscientious objectors and draft evaders is too lenient.
6. Manual labor and menial jobs seem to fit the Negro mentality and ability better than more skilled or responsible work.
7. Too much of the tax dollar is spent supporting the poor.
8. Our schools would be better with more minority groups represented.
9. City riots are a threat to our suburban life.
10. City rioters demonstrate that inferior groups, when they are given too much freedom and money, just misuse their privileges and create disturbances.
11. It is possible that this neighborhood would deteriorate with open housing.
12. Blacks are discriminated against.
13. Welfare encourages illegitimacy.
14. Busing children to achieve racial balance is desirable.
15. Blacks may have a part to play in White civilization, but it is best to keep them in their own districts and schools and to prevent too much intermixing with Whites.
16. It would be a mistake to have Blacks for foremen and leaders over Whites.
17. This town government is doing too little to encourage integration.
18. Fair and open housing will probably drive property values down in this neighborhood.
19. Riots have brought about some long overdue action by city governments to help the Black community.
20. It is possible that this neighborhood would deteriorate if minority group families were permitted into this area.
21. If a Black family comes to live in this area, welfare families will soon follow.
22. Black power movements can lead only to violence.
23. More minority group families in this community would be desirable.
24. Special government programs should be devised to make it easier for minority group families to live in this area.
25. Blacks would solve many of their social problems by not being so irresponsible and lazy.
26. Patriotism and loyalty are the first and most important requirements of a good citizen.
27. There will always be wars because there will always be races who ruthlessly try to grab more than their share.
28. Our neighborhood is better off without minority groups.
29. Law and order must be established as the first order of business.
30. The people who raise all the talk about putting Blacks on the same level as Whites and giving them the same privileges are mostly radical agitators trying to stir up conflicts.
31. There is something inherently primitive and uncivilized in the Negro, as shown in his music and aggressiveness.
32. Welfare, although imperfect, is a necessity for many.
33. Open and fair housing can be achieved without government programs.
34. My neighborhood is open to Negroes who care to come to live.

```
1 REM ** WESTWOOD SURVEY.  TO BASIC BY MARK GROSS.  AUG 25,1970 **
2 DIM A(35),C(35)
5 PRINT "*** TO OPERATOR- ENTER NO. OF SUBJECTS";
7 INPUT S8
10 PRINT "BEFORE STARTING THIS TEST, YOU SHOULD HAVE A LIST"
15 PRINT "OF THE QUESTIONS.  IF YOU DON'T, TYPE CTRL/C AND"
20 PRINT "THE MACHINE WILL STOP."
25 PRINT
30 PRINT "RATE YOURSELF.  DO YOU REGARD YOURSELF AS:"
35 PRINT "1> VERY PREDJUDICED, 2>  MODERATELY SO"
40 PRINT "3> SLIGHTLY PREDJUDICED, OR 4> NOT AT ALL."
45 PRINT "ANSWER";
50 INPUT S1
60 PRINT "OK--NOW INDICATE YOUR AGREEMENT WITH THE STATEMENTS ON"
65 PRINT "YOUR SHEET ACCORDING TO THE FOLLOWING SCALE:"
70 PRINT "1-STRONGLY DISAGREE, 2-MODERATELY DISAGREE,"
72 PRINT "3-SLIGHTLY DISAGREE, 4-SLIGHTLY AGREE, "
75 PRINT "5-MODERATELY AGREE, OR 6-STRONGLY AGREE"
80 FOR X=1 TO 34
85 PRINT "#";X;
90 INPUT A(X)
91 IF A(X)>6 THEN 94
92 IF A(X)<1 THEN 94
93 GOTO 95
94 PRINT "ILLEGAL RESPONSE"\GOTO 85
95 NEXT X
100 LET A(2)=7-A(2)
105 LET A(4)=7-A(4)
110 LET A(8)=7-A(8)
115 LET A(9)=7-A(9)
120 LET A(12)=7-A(12)
125 LET A(14)=7-A(14)
130 LET A(17)=7-A(17)
135 LET A(19)=7-A(19)
140 LET A(23)=7-A(23)
145 LET A(24)=7-A(24)
150 LET A(32)=7-A(32)
152 PRINT "YOU RATED YOURSELF AS ";
155 IF S1=1 THEN 190
160 IF S1=2 THEN 185
165 IF S1=3 THEN 180
170PRINT "NOT"
175 GO TO 195
180 PRINT "SLIGHTLY ";
182 GO TO 195
185 PRINT "MODERATELY ";
187 GO TO 195
190 PRINT "VERY ";
195 PRINT "PREDJUDICED."
200 IF C=1 THEN 245
205 LET C=1
206 PRINT "I RATE YOU AS ";
210 FOR X=1 TO 34
215 LET S3=S3+A(X)
220 NEXT X
225 IF S3<76 THEN 170
230 IF S3<119 THEN 180
235 IF S3<161 THEN 185
240 GO TO 190
245 LET C=0
250 LET S3=0
255 LET S9=S9+1
260 FOR X=1 TO 34
265 IF A(X)>3 THEN 275
270 GO TO 280
275 LET C(X)=C(X)+1
280 NEXT X
285 IF S9>=S8 THEN 305
290 LET S3=0
295 PRINT "--------------------------------"
300 GO TO 25
305 PRINT "*** TO OPERATOR-HERE IS THE TABULATION"
306 READ T
310 FOR X=1 TO 34
315 PRINT "#";X;" WAS ANSWERED IN A RACIST MANNER";C(X);" TIMES";
320 IF C(X)>(T/100)*S8 THEN 335
325 PRINT
330 GO TO 340
335 PRINT "**"
340 NEXT X
345 PRINT
350 PRINT "** MEANS THAT THE 'QUESTION' WAS ANSWERED IN A 'RACIST'"
355 PRINT "MANNER BY OVER ";T;"% OF THE SUBJECTS"
356 PRINT "DISCUSSION. ***"
360 STOP
361 REM ** STMNT 362 IS % OF 'RACIST ANS' FROM CLASS FOR DISCUSSION
362 DATA 20
365 END
```

Humanize Your Primary Typewriter

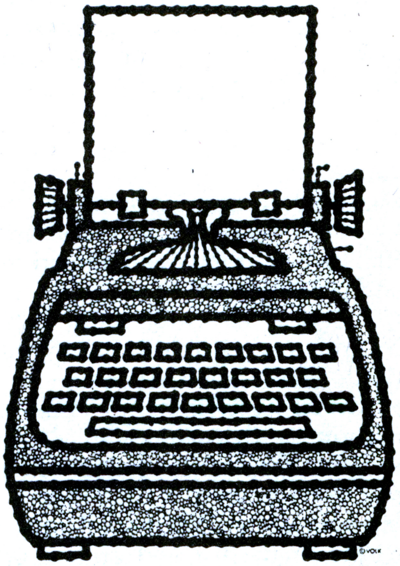
■ Kindergarten teacher Janet Carter of the Marlboro Village School (Monmouth Co.) makes excellent use of her primary typewriter by "Humanizing" it.

She recommends for those who do not have a machine, to order an extra long carriage so that all size paper can be used. She feels it is not necessary to teach typing but limits should be put on the typewriters use.

Allowing students to hunt and peck for their name is one use while allowing children to type words they have just learned from reading a story is another. She feels this is an excellent reinforcement to the reading lesson.

Another way she uses the typewriter is to have students relate how they feel about something and type their feeling. The stories can be bound in a simple book to be read and re-read at a later time.

Students write a newspaper after they have several weeks of "Show and Tell" experience. This is used for reading readiness. Over a period of a few weeks, everyone has a chance to talk, to be listened to, and have their talk written down on the typewriter to be duplicated for everyone to enjoy.



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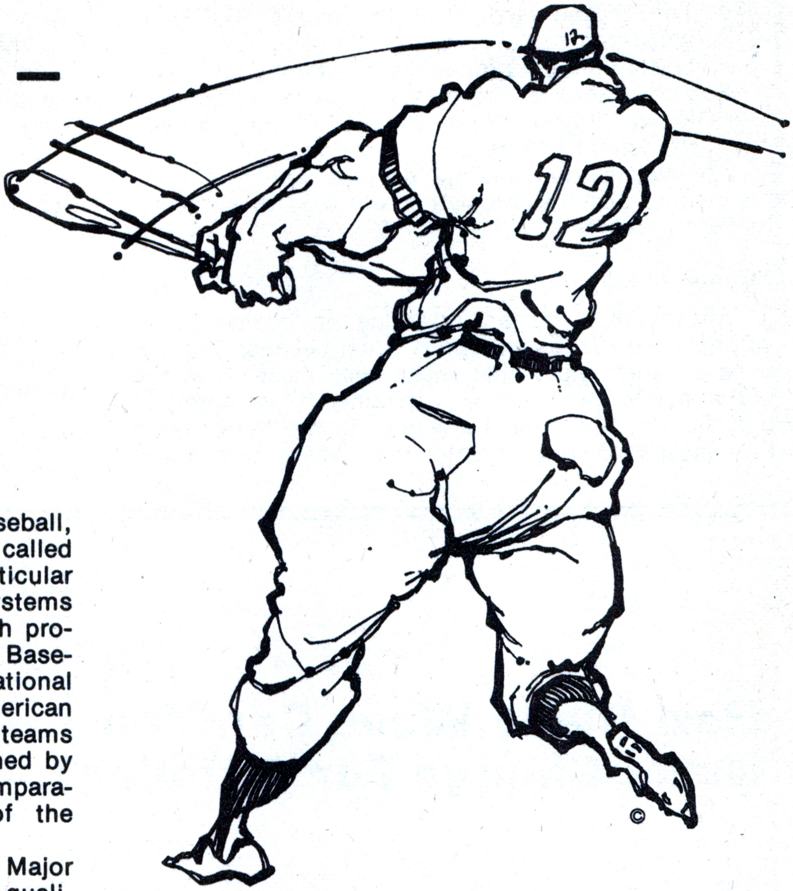
Of course

I know what's going on...

I just don't understand it!

The World of Series — Playoff That Is



James Reagan
Stevenson High School
Sterling Heights, Mich.

What Are Playoffs?

Traditionally the professional sports of baseball, basketball, and hockey have held what are called championship playoffs to determine the particular sport league champion. Comparable playoff systems are used after the regular season ends by such professional sport organizations as Major League Baseball, the National Football League, the National Hockey League, and the National and American Basketball Associations. An even number of teams qualify for the championship playoffs determined by their regular season record and/or by their comparative standing within a particular division of the league.

The playoff setup may be illustrated by Major League Baseball. Each of the division winners qualifies for the playoffs. The winners of the two American League divisions, East and West, play each other in a best-of-five games series while the National League divisional winners play their best-of-five series. (In a best-of-five series the first team to win three games is the winner of the series.) The winner of the World Series is considered the best team in baseball.

There has been a trend in the major professional sports to expand—add teams to the respective leagues. This has changed many previous playoff systems to include more teams qualifying for the championship playoffs. For example, the National Basketball Association now has a first round series in which there are two best-of-three series before the semi-final and final playoffs.

Some of the criticism of professional sport expansion is that the entire championship structure is designed to add revenue to the pockets of the team owners and the best team is not necessarily the one that wins.

Let us investigate some of the questions and results of employing a championship playoff system.

First Investigation

If we consider that playoff series are a money generating activity, how much money can the competing teams, not necessarily the players, expect to earn? The earnings are reflected in the number of games that can be expected to be played. In a best-of-seven series, there could be four, five, six, or seven games played. Which number of games should we expect?

Certainly games cannot or should not be fixed so that there can be more games in the series; that is both illegal and unethical. Just let things go naturally and see what happens.

We can use the computer to simulate each game of the series and keep track of how many games it takes to win each of several series simulations. For each game we will presently assume each team is equally likely to win, just as flipping a coin is usually considered equally likely to be a head or a tail. When a team wins four games the series is over and we tally the number of games played in the series. If the series ends in four games, we increase the count for four game series by one; similarly, we add to the counts for series ending in five, six, or seven games. After a large number of playoff series simulations, perhaps a hundred, we will have some idea of the expected number of games for a best-of-seven game series. The following questions arise and can be answered from the simulations:

1. Is a prediction of a "four game sweep" reasonable?
2. Is a prediction that the series will go six or seven games really going out on a limb?
3. How well do the results of the simulation agree with actual outcomes of Major League World Series or other best-of-seven championship playoffs?

Many preliminary playoffs are not best-of-seven. Some are best-of-five and some are best-of-three. How should the series results be expected to be distributed with these kinds of playoffs?

We originally assumed that the probability that a team would win any game was 0.5; but, seldom are the two teams equally likely of winning a given game. There are many factors affecting the *a priori* probability of a team winning a game. Some of the factors are:

1. The place where the game is played. Does the home team have the advantage?

2. The season records of the teams. The team with the better season record may have a better than 0.5 probability of winning a game.
3. The winner of the previous game. A psychological advantage is usually associated with the team that has won the previous game.

An investigation stating the probability influencing factors and the simulation will lead to some interesting results.

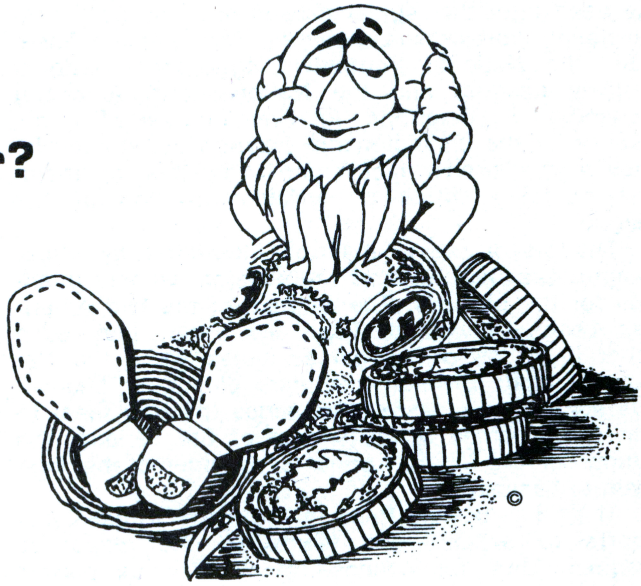
Second Investigation

An equally important investigation is one which will help answer the question: "Just because Team A wins a series, does that mean that Team A is the better of the two teams?" Certainly if we agree to use the criterion that the winner is the better team the answer to the question is "Yes". But, most sports fans have a preconceived idea of which team is the better of the two. Now I rephrase the question: "If Team A is better than Team B, what is the probability that Team A will win a best-of-seven series from Team B?"

By Team A being better than Team B I mean that for any game that they play, the probability that Team A will win, P(A), is greater than the probability that Team B will win, P(B). If we first consider P(A) = 0.55, what is the probability that Team A will win the series? The question can be answered using various probabilities for Team A.

Further, if Team A is better than Team B, what is the probability that Team A will win a best-of-five series? I recently heard a sportscaster say, "Anything can happen in a five game series." Finally, what happens in a best-of-three series as in the NBA?

How Many Ways Can You Make Change For A Dollar?



by Brian Hess

Even with all the nickels and dimes and pennies running around this country, somebody still always needs change for a dollar for this or that. Assuming that you carried around enough change, how many ways could you help out someone who needed the right change for some infernal vending machine? You can use half-dollars, quarters, dimes, nickels, or pennies to make the right change. For example, you could give him 1 half, 1 quarter, 1 dime, 2 nickels, and 5 pennies. Get it?

There are a few different ways to solve the problem. One is to break it down into smaller problems, easily solved (e.g., how many ways can you make change for a quarter?) and then combine the answers to get the "big" answer. Another mathematical method would be to write out a series of equations relating each piece of change to each other and the dollar and then solve them. Finally, you could do the problem by exhaustion.

Solving a problem by exhaustion means writing down all the answers until all the possibilities of solution are exhausted (or until you are exhausted, whichever comes first). Fortunately, you *Creative Computing* readers can exhaust a computer rather than yourselves. Write a program to figure out how many ways you can make change for a dollar. Print the ways as well as a final total. (WARNING: Printing takes time on a TTY—if you are in a hurry [or being charged] don't bother printing all the ways, just the final total.)

Hints: 1) If you use loops, counting one by one, it will probably take close to 20 minutes to compute all of it (even without printing all the combinations). Do you have to index the "pennies-counter" by one? Once the half-dollar counter reaches 2, what happens to all the other nested coin-counters? What about 4 quarters? Dimes?

2) If your program doesn't come out with well over 100 ways to make change for a dollar, it has something wrong with it. (I'm not going to tell you the exact answer—work it out for yourself!)

3) Once you have gotten the answer, ask some friends to guess at what they think it is. You'll hear some very interesting numbers. Use the computer to tabulate them, etc.

4) Write some sort of applications changes for this program. Look at how the number of combinations changes. For example, nobody uses half-dollars in vending machines, so restrict the number of halves to 1. Also, who wants more than 25 pennies? Only parking meters and gumball machines use them. Finally, include at least 1 dime in the change so that your changeless friend can make a phone call!

Brian is a high school student in Western Springs, Illinois.

CREATIVE PROGRAMMING TECHNIQUES....

*In this regular column, **Creative Computing** will publish original programming techniques, hints, and tricks. We're not looking for material from textbooks, but we are seeking material from readers that has proved helpful and effective. Send contributions to Editor, **Creative Computing**. The techniques presented below are from the Advisory Unit for Computer Based Education, Hertfordshire County Council, England.*

CONDITIONAL STATEMENTS

It is probably a fair generalisation to say that the comparison statement in any high level language is one to be avoided wherever possible. It usually translates into a sequence of arithmetic operations followed by a comparison with zero, which is usually the basic comparison operation available in the machine code.

As, contrariwise, the comparison instruction is fundamental to any serious programming, it is natural to look at some ways of using it as little as possible. We offer some general hints:

In a language which allows compound 'logical' statements, such as FORTRAN, it is often wise to re-write such a statement using simpler statements, particularly where "OR" is being used. The following is probably transparent to readers without any knowledge of FORTRAN.

Instead of:

```
IF (COST.EQ.0.0 .OR. TIME.LT.9.5 .OR.
   DAYS.GT.5.0) GO TO 9995
```

it is better to write:

```
IF (COST.EQ.0.0) GO TO 9995
IF (TIME.LT.9.5) GO TO 9995
IF (DAYS.GT.5.0) GO TO 9995
```

and best to order these three conditional statements so that the one most likely to be satisfied is tried first. The philosophy behind this is clear; if the COST is zero, we do not need to try the other two conditionals, but it is often the case with some systems that the full logical value of the compound conditional statement will be computed before branching.

THERE'S ALWAYS
AN EASY SOLUTION
TO EVERY PROBLEM

NEAT . . . PLAUSIBLE . . . AND WRONG

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SEARCHING A LIST

Another interesting technique is concerned with searching an unordered list for a particular entry. Imagine we have a list of names:

GILLIAN, JOSEPHINE, CINDY, ANGELA, DAPHNE,......, JEAN

stored in the one-dimensional array A$(1), A$(2),......, A$(n), and we wish to find out whether "PHOEBE" is one of the names on this list. An 'obvious' approach is contained in this program fragment:

```
300 LET I =0
310 LET I = I+1
320 IF I> N THEN 500
330 IF A$ (I) = "PHOEBE" THEN 400
340 GO TO 310
•
•
400 PRINT "PHOEBE FOUND AS THE
";I;"-TH NAME ON THE LIST"
•
•
500 PRINT "NAME NOT FOUND ON LIST"
```

The comparison at line 320 is necessary because we must detect the end of the list in the event of not finding "PHOEBE".

However, if we adjust the list, in order to ensure that "PHOEBE" is always found, by adding it as the N+1 th element, we can avoid this comparison. The program then becomes:

```
300 LET A$(N+1) = "PHOEBE"
310 LET I = 0
320 LET I = I+1
330 IF A$ (I) = "PHOEBE" THEN 400
340 GOTO 320
400 IF I = N + 1 THEN 500
410 PRINT " PHOEBE FOUND . . . . . . . .&c"
•
•
500 PRINT "NOT FOUND &c . . . ."
```

Now the comparison at line 400 will be executed once instead of N+1 times. This might not be a saving, however. As in all 'short-cuts' of this nature, it may happen that the overheads of time or core-space used by arranging the short-cut are more expensive than the saving. In general, the longer the list, the better the saving.

Thinkers' Corner

by Layman E. Allen © 1976

MATHEMATICS PUZZLES

How many of the problems (a) through (f) below can be solved by forming an expression equal to the GOAL? (Suppose that each symbol below is imprinted on a disc.)

The expression must use:

(1) only single digits combined with operators,
(2) all of the discs in the REQUIRED column,
(3) as many of the discs in PERMITTED as you wish, and
(4) exactly one of the discs in RESOURCES.

Special Rules:

The '*' indicates "to the power of." Thus 3*2 = 3^2 = 9.

The '√' indicates "the nth root of." Thus $\sqrt[3]{8} = 2$.

Parentheses can be inserted anywhere to indicate grouping, but never to indicate multiplication.

Problem	GOAL	REQUIRED	PERMITTED	RESOURCES
(a)	18	5+	48+	-X÷√ 249
(b)	9	7-	28÷	-X÷* 678
(c)	11	8÷	26-	+-X * 148
(d)	6	23 -	158	--X ÷245
(e)	1	34 ÷	26+ -	-X÷0 125
(f)	10	46 *	23÷	+-√ 1 249

Some Suggested Answers (frequently there are others):

(a) 4 + 5 + 9
(b) (8 X 2) - 7
(c) (6 ÷ 2) + 8
(d) 5 - (2 - 3)
(e) (2 ÷ 4) + (3 ÷ 6)
(f) (4 * 2) - 6

If you enjoy this kind of puzzle, you might like playing EQUATIONS: The Game of Creative Mathematics. Free information about this and other instructional games is available upon request from The Foundation for the Enhancement of Human Intelligence, 1900-E Packard Road, Ann Arbor, MI 48104.

COMPUTER RECREATIONS

by D. Van Tassel

Self-reproducing program

Every so often one runs into a program that is really interesting to write but very simple to understand. I won't claim credit for this program since it has appeared in various forms in other places. Here is the program: Write a program that prints an exact copy of itself. No input statements are allowed.

This can be done in any programming language. The program is an interesting exercise in program planning. For those who do not feel the above program is a sufficient challenge I offer the following interesting variation: The Dizzy Operator Program.

Write a program that prints an exact copy of itself. No input statements are allowed. In addition because the computer operator is quite careless and sometimes puts the cards (or paper tape) in the machine upside down the program should execute exactly the same, either way.

Now if anyone sends me a nice solution to either problem, I will publish it in a later column. (Send to D. Van Tassel, Computer Center, Univ. of California, Santa Cruz, CA 95064).

Dennie Van Tassel is the author of *Program Style, Design, Efficiency, Debugging, and Testing*. Many of the problems in this "Computer Recreations" series come from this book. Dennie also edited the newly-released *The Compleat Computer* published by SRA.

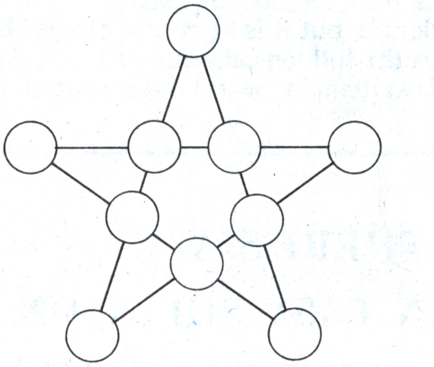
A BICENTENNIAL MAGIC STAR

by Carl E. Heilman
Pa. Dept. of Education
P.O. Box 911
Harrisburg, PA 17126

Of course, all of you know the story of Betsy Ross and the clever manner in which she folded a piece of paper or cloth and with a single snip of her shears, cut it to form a symmetrical five-pointed star. I hope you know how to duplicate her construction and will take advantage of its appropriateness for both Christmas and the Fourth of July.

But my intention is to suggest that you relate more closely to George Washington and the cherry tree when George's father, after the tree was cut down, told George he wanted him to plant ten trees in place of the one chopped down. It was a sort of tithing program in reverse. But George had to plant the ten trees in five rows with four trees in each row. Imagine George's surprise when he found Betsy Ross's five-pointed star staring him in the face!

Now my suggestion is to place a different integer at each of those points of intersection, so that the sum of the integers in each row is 76. The word "different" avoids the obvious solution which uses 19 at each point of intersection. Using integers, I have obtained three different solutions, one using the values 13, 14, 15, 16, 17, 20, 22, 23, 24, 26. I should like to know how many different solutions can be discovered and whether there is any way of determining the total number of distinctly different solutions, those using different groups of ten numbers. I should appreciate any reference which studies this problem of the magic five-pointed star.



Since this problem first appeared in the Fall 1975 *PCTM Newsletter*, I have received some 60 different solutions from teachers and students in the Wyoming Valley West High School, Plymouth, PA. But there is still no conjecture as to the total number of possible solutions. Can anyone out there in *Creative Computing* land help?

Puzzles and Problems For Fun

THREE BOYS

Three boys weigh a total of 350 pounds, of which Bill weighs 105 pounds. The barefoot boy weighs exactly 15 pounds less than the heaviest boy. Chuck weighs more than the boy with sneakers on. Art weighs less than the boy with loafers on.

Which boy is barefoot?

Games & Puzzles

NO COMPUTER NEEDED

Solve the following equations for x and y *in your head.*

$$6751x + 3249y = 26751$$
$$3249x + 6751y = 23249$$

ARRANGE

Can you arrange the letters of the magazine title CREATIVE COMPUTING in a 5 x 5 square grid so that starting at a C and proceeding one step at a time to a neighboring letter (horizontally, vertically or diagonally), the phrase can be spelled out in as many different ways as possible. For example, in the arrangement below CREATIVE COMPUTING can be spelled out in no fewer than 100 different ways. Can you improve on that? Any letter may appear any number of times and a spelling out of the phrase may pass through the same letter more than once.

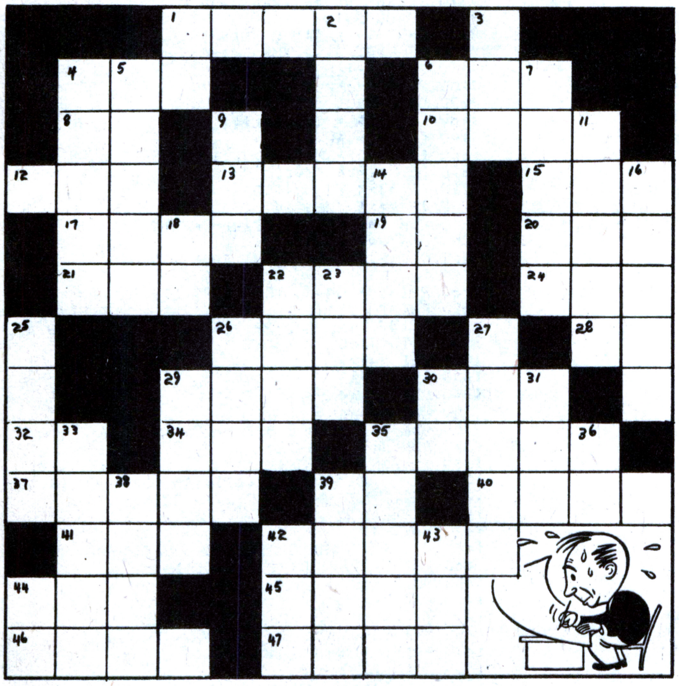
R	R	A	T	I
C	E	E	I	T
O	C	V	A	G
M	O	T	I	N
P	U	I	N	G

You try here.

Adapted by David Ahl
from a puzzle in *Games & Puzzles.*

"COMPUTER CAREERS"

by John K. Young
Braintree, Mass.



ACROSS

1 Repeat a set of operations
4 Price
6 Pin for separating ropes
8 Else
10 Separate piece of information
12 Make a mistake
13 Clear
15 The lion
17 Transfer from one memory register to another
19 Old Latin
20 Part of curved line
21 Period of time
22 Electromagnet for reading
24 Youth of Greater Tacoma
26 Repetition of instructions
28 Electronic Association
29 Storage for information unit
30 Path for transferring information
32 Member of Parliament
34 (•)
35 Artificial unit
37 Adolescent hair growth
39 One hundred one
40 Combine different fields of information into one machine word
41 Nickname
42 Counterfeit
44 Pool
45 Arrange information for output unit
46 Hoofed, cud-chewing animal
47 Circuit with two inputs and one output

DOWN

1 Computer electronics
2 Volcano flow
3 Single pulse
4 Intervene
5 Loss of precision
6 Set of columns in punch cards
7 Line for storing information in train of pulses
9 Set of identifying characters
11 Produce single sequence from two or more
14 Anathema to hippies
16 Digit in scale of eight
18 Dad
22 Retain information
23 Eastern Order of Lithographers
25 Withdraw power
26 Glass for converging spreading rays of light
27 Directs computer to next instruction
29 City in northern France
30 Boston University
31 Southern Methodist Alumni
33 Sharp voltage change
35 Symbol in scale of ten
36 Youth Corps
38 Radix in numbers scale
39 Close of musical composition
42 Implore
43 Indian tribe
44 Paid newspaper notice

Another new game from Creative Computing . . . .

WATCHMAN

Written by: Mac Oglesby, Putney, Vermont.
Language: Standard BASIC.

Description: This is a new version of the old "draw the figure without retracing or lifting your pencil" topological puzzle. The user acts as a watchman hired to patrol the streets of a small village as efficiently as possible. To do this he must find a path that will not retrace any earlier steps.

Suggestions: For CRT users—
(1) Clear screen before every map.
(2) Blink the character showing current position.

```
100 REM WATCHMAN  (BASIC PROGRAM BEGINS AT LINE 240)  WAS WRITTEN BY
110 REM MAC OGLESBY, PUTNEY, VT.  05346 IN FEBRUARY 1975.
120 REM LAST CHANGED IN MARCH 1975 BY BILL COTTER
130 REM
140 REM DESCRIPTION--YOU'VE BEEN HIRED TO PATROL THE VILLAGE STREETS
150 REM WITHOUT RETRACING STEPS.  AN OPTIONAL MAP AFTER EACH TURN SHOWS
160 REM YOUR LOCATION AND FOOTPRINTS.  A NEW VERSION OF AN OLD "DRAW
170 REM THE FIGURE WITHOUT RETRACING OR LIFTING YOUR PENCIL" TOPOLOGICAL
180 REM PUZZLE.
190 REM
200 REM INSTRUCTIONS--TYPE RUN
210 REM
220 REM *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
230 REM *** INITIALIZATION
240 DIM D(23),P(15,23)
250 LET A3$ = ","
260 LET F=I=M=0
270 FOR J=1 TO 15
280     READ D$
290     CHANGE D$ TO D
300     FOR K=1 TO D(0)
310        LET P(J,K)=D(K)
320     NEXT K
330 NEXT J
340 DATA "      O**********O","        * 1ST ST. *","          *          *"
350 DATA ******O**********O*******,*1    2* 2ND ST. *3   4*
360 DATA *S   N*          *R   T*,*T   D* 3RD ST. *D   H*
370 DATA *      O**********O      *,*A   A*             *A   A*
380 DATA *V   V*          *V   V*,*E   E* 4TH ST. *E   E*
390 DATA *N     O**********O*******,*U                  *
400 DATA *E       5TH ST. *,******************
410 MATREAD E(5,4)
420 DATA 1,15,21,1,15,210,210,21,6,30,42,6,6,10,210,14,10,35,14,1
430 FOR J=1 TO 5
440     READ R(J)
450 NEXT J
460 DATA 1,4,8,12,15
470 FOR J=1 TO 4
480     READ C(J)
490 NEXT J
500 DATA 1,7,17,23
510 FOR J=1 TO 5
520     READ G$(J)
530 NEXT J
540 DATA ST,ND,RD,TH,TH
550 FOR J=1 TO 8
560     READ B(J)
570 NEXT J
580 DATA 12,13,22,23,32,33,42,43
590 PRINT
600 PRINT "WATCHMAN   ";DAT$
610 PRINT "WANT INSTRUCTIONS";
620 INPUT I$
630 IF I$<>"NO" THEN 660
640 LET I=1
650 GOTO 690
660 PRINT
670 PRINT "YOU'VE BEEN HIRED AS WATCHMAN FOR THE VILLAGE."
680 PRINT "YOUR JOB IS TO PATROL ALL ITS ROADS WITHOUT RETRACING STEPS."
690 PRINT
700 PRINT "VILLAGE MAP:"
710 GOSUB 2550
720 IF I=1 THEN 770
730 PRINT "YOU NAME A CORNER BY TYPING 2 NUMBERS; FIRST THE STREET,"
740 PRINT "THEN THE AVENUE.  FOR EXAMPLE, 32 MEANS THE CORNER OF"
750 PRINT "3RD ST. AND 2ND AVE."
760 REM *** GET MOVES
770 PRINT
780 IF M>0 THEN 850
790 PRINT "YOU BEGIN AT ANY CORNER MARKED O"
800 PRINT "BEGIN WHERE (ST.,AVE.)";
810 INPUT A1$,A2$
820 LET A$=A1$&A3$
830 LET A$=A$&A2$
840 GOTO 1110
850 PRINT "YOU'RE AT";A1;G$(A1);" STREET AND";A2;G$(A2);" AVENUE."
860 IF M=2 THEN 970
870 IF I=1 THEN 940
880 PRINT
890 PRINT "AT EACH TURN YOU WALK TO ANY ADJACENT CORNER WHICH IS"
900 PRINT "CONNECTED BY A ROAD NOT TROD EARLIER."
910 PRINT "ALTHOUGH YOU CAN'T WALK ON ANY ROAD TWICE, YOU MAY"
920 PRINT "REVISIT CORNERS."
930 PRINT
940 LET M=2
950 GOTO 1040
960 REM *** GAME OVER?
970 IF E(A1,A2)>1 THEN 1030
980 PRINT "WANT FINAL MAP";
990 INPUT M$
1000 IF M$="NO" THEN 2700
1010 GOSUB 2530
1020 GOTO 2700
1030 PRINT "FOR A MAP TYPE '0,0'"
1040 PRINT "WALK TO WHAT CORNER (ST.,AVE.)";
1050 INPUT A1$,A2$
1060 LET A$=A1$&A3$
1070 LET A$=A$&A2$
1080 IF A$<>"0,0" THEN 1110
1090 GOSUB 2530
1100 GOTO 1040
1110 IF LEN(A$)>9 THEN 1150
1120 GOSUB 2410
1130 REM *** LEGAL COMMAND?
1140 IF LEN(A$)=2 THEN 1180
1150 PRINT "ILLEGAL MOVE!"
1160 PRINT "INPUT IGNORED."
1170 GOTO 770
1180 LET Z9$ = SST(A$,1,1)
1190 LET A3=VAL(Z9$)
1200 LET Z9$ = SST(A$,2,1)
1210 LET A4=VAL(Z9$)
1220 IF A4>4 THEN 1150
1230 IF M=>1 THEN 1470
1240 REM *** CAN HE START THERE?
1250 FOR J=1 TO 8
1260     IF VAL(A$)=B(J) THEN 1320
1270 NEXT J
1280 PRINT "SORRY, YOU CAN'T START THERE!"
1290 PRINT "START AT ONE OF THESE CORNERS:"
1300 PRINT "12, 13, 22, 23, 32, 33, 42, OR 43."
1310 GOTO 1160
1320 LET M=1
1330 LET A1=A3
1340 LET A2=A4
1350 LET O$=A$
1360 REM *** CHANGE O TO * ON THE MAP
1370 FOR J=1 TO 5
1380     FOR K=1 TO 4
1390        IF P(R(J),C(K))<>ASC(O) THEN 1410
1400        LET P(R(J),C(K))=ASC(*)
1410     NEXT K
1420 NEXT J
1430 REM *** MARK BEGINNING LOCATION
1440 LET P(R(A1),C(A2))=ASC(&)
1450 GOTO 770
1460 REM *** ADJACENT CORNER?
1470 IF VAL(O$)<>VAL(A$) THEN 1510
1480 PRINT "YOU'RE AT THAT CORNER NOW!"
1490 PRINT "INPUT IGNORED."
1500 GOTO 1030
1510 LET Z9$=SST(O$,1,1)
1520 LET O1=VAL(Z9$)
1530 LET Z9$=SST(O$,2,1)
1540 LET O2=VAL(Z9$)
1550 IF A3-O1=0 THEN 1580
1560 IF ABS(A3-O1)=1 THEN 1590
1570 GOTO 1150
1580 IF ABS(A4-O2)=1 THEN 1610
1590 IF A4-O2<>0 THEN 1150
1600 REM *** WHERE'S HE HEADED?
1610 IF A3-O1<>0 THEN 1720
1620 IF A4-O2<0 THEN 1680
1630 REM *** EAST?
1640 LET H=5
1650 LET H1=7
1660 GOTO 1800
1670 REM *** WEST?
1680 LET H=7
1690 LET H1=5
1700 GOTO 1800
```

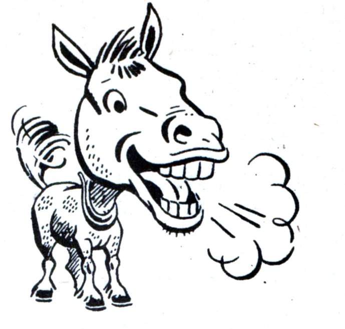
```
1710 REM *** NORTH?
1720 IF A3-01>0 THEN 1770
1730 LET H=2
1740 LET H1=3
1750 GOTO 1800
1760 REM *** SOUTH?
1770 LET H=3
1780 LET H1=2
1790 REM *** DOES PATH EXIST AND IS IT UNTROD?
1800 IF E(01,02)/H<>INT(E(01,02)/H) THEN 1150
1810 REM *** MOVE SEEMS LEGAL, SO RECORD FOOTSTEPS
1820 LET A1=A3
1830 LET A2=A4
1840 LET 0$=A$
1850 LET E(01,02)=E(01,02)/H
1860 LET E(A1,A2)=E(A1,A2)/H1
1870 REM *** MARK HIS LOCATION
1880 LET P(R(A1),C(A2))=ASC(&)
1890 LET P(R(01),C(02))=ASC(*)
1900 REM *** KEEP VACATED CORNER?
1910 IF E(01,02)>1 THEN 1930
1720 LET P(R(01),C(02))=ASC(:)
1930 IF H<>2 THEN 1980
1940 FOR J=1 TO ABS(R(A1)-R(01))-1
1950     LET P(R(01)-J,C(02))=ASC(:)
1960 NEXT J
1970 GOTO 2120
1980 IF H<>3 THEN 2030
1990 FOR J=1 TO ABS(R(A1)-R(01))-1
2000     LET P(R(01)+J,C(02))=ASC(:)
2010 NEXT J
2020 GOTO 2120
2030 IF H<>5 THEN 2080
2040 FOR J=1 TO ABS(c(A2)-C(02))-1
2050     LET P(R(01),C(02)+J)=ASC(:)
2060 NEXT J
2070 GOTO 2120
2080 FOR J=1 TO ABS(C(A2)-C(02))-1
2090     LET P(R(01),C(02)-J)=ASC(:)
2100 NEXT J
2110 REM *** CONTINUE WALK IF NO CHOICE IS AVAILABLE
2120 IF E(A1,A2)>7 THEN 770
2130 IF E(A1,A2)=6 THEN 770
2140 IF F=1 THEN 2200
2150 IF I=1 THEN 2190
2160 PRINT
2170 PRINT "(THE COMPUTER AUTOMATICALLY MOVES YOU ALONG TO THE NEXT CORNER"
2180 PRINT "AT WHICH A DECISION IS NECESSARY.)"
2190 LET F=1
2200 IF E(A1,A2)<>7 THEN 2250
2210 LET A4$=STR$(10*A1-1+A2)
2220 LET A9=LEN(A4$)
2230 LET A$=SST(A4$,A9-2,2)
2240 GOTO 1140
2250 IF E(A1,A2)<>5 THEN 2300
2260 LET A4$=STR$(10*A1+1+A2)
2270 LET A9=LEN(A4$)
2280 LET A$=SST(A4$,A9-2,2)
2290 GOTO 1140
2300 IF E(A1,A2)<>3 THEN 2350
2310 LET A4$=STR$(10*A1+10+A2)
2320 LET A9=LEN(A4$)
2330 LET A$=SST(A4$,A9-2,2)
2340 GOTO 1140
2350 IF E(A1,A2)<>2 THEN 770
2360 LET A4$=STR$(10*A1-10+A2)
2370 LET A9=LEN(A4$)
2380 LET A$=SST(A4$,A9-2,2)
2390 GOTO 1140
2400 REM *** ROUTINE TO DROP COMMAS, DASHES, ETC.
2410 LET C1=0
2420 CHANGE A$ TO A
2430 FOR J=1 TO A(0)
2440     IF (ASC(5)-A(J))*(A(J)-ASC(1))<0 THEN 2470
2450     LET C1=C1+1
2460     LET A(C1)=A(J)
2470 NEXT J
2480 LET A(0)=C1
2490 CHANGE A TO A$
2510 RETURN
2520 REM *** PRINT MAP ROUTINE
2530 PRINT
2540 PRINT "& = YOU   :::: = FOOTPRINTS"
2550 PRINT
2560 FOR J=1 TO 15
2570     LET D(0)=0
2580     FOR K=23 TO 1 STEP -1
2590     IF P(J,K)>32 THEN 2610
2600     IF D(0)=0 THEN 2630
2610     LET D(K)=P(J,K)
2620     LET D(0)=D(0)+1
2630     NEXT K
2640     CHANGE D TO D$
2650     PRINT D$
2660 NEXT J
2670 PRINT
2680 RETURN
2690 REM *** END OF GAME
2700 PRINT
2710 REM *** LOSER?
2720 FOR J=1 TO 5
2730     FOR K=1 TO 4
2740         IF E(J,K)=1 THEN 2770
2750         PRINT "YOU WERE SUPPOSED TO PATROL THE WHOLE VILLAGE!"
2760         GOTO 2820
2770     NEXT K
2780 NEXT J
2790 REM *** WINNER!!
2800 PRINT "*** CONGRATULATIONS ***"
2810 PRINT "YOU'VE WALKED THROUGHOUT THE VILLAGE WITHOUT RETRACING STEPS!"
2820 PRINT "TYPE RUN TO TRY AGAIN."
2830 END

ready
```

SAMPLE RUN

```
WATCHMAN   05/06/75
WANT INSTRUCTIONS ?YES

YOU'VE BEEN HIRED AS WATCHMAN FOR THE VILLAGE.
YOUR JOB IS TO PATROL ALL ITS ROADS WITHOUT RETRACING STEPS.

VILLAGE MAP:

      0*********0
      * 1ST ST. *
      *         *
******0*********0******
*1   2* 2ND ST. *3   4*
*S   N*         *R   T*
*T   D* 3RD ST. *D   H*
*     0*********0     *
*A   A*         *A   A*
*V   V*         *V   V*
*E   E* 4TH ST. *E   E*
*N    0*********0******
*U              *
*E      5TH ST. *
*****************

YOU NAME A CORNER BY TYPING 2 NUMBERS: FIRST THE STREET,
THEN THE AVENUE.  FOR EXAMPLE, 32 MEANS THE CORNER OF
3RD ST., AND 2ND AVE.

YOU BEGIN AT ANY CORNER MARKED 0
BEGIN WHERE (ST.,AVE.) ?2,2

YOU'RE AT    2 ND STREET AND    2 ND AVENUE.

AT EACH TURN YOU WALK TO ANY ADJACENT CORNER WHICH IS
CONNECTED BY A ROAD NOT TROD EARLIER.
ALTHOUGH YOU CAN'T WALK ON ANY ROAD TWICE, YOU MAY
REVISIT CORNERS.

WALK TO WHAT CORNER (ST.,AVE.) ?2,1

(THE COMPUTER AUTOMATICALLY MOVES YOU ALONG TO THE NEXT CORNER
AT WHICH A DECISION IS NECESSARY.)

YOU'RE AT    4 TH STREET AND    3 RD AVENUE.
FOR A MAP TYPE '0,0'
WALK TO WHAT CORNER (ST.,AVE.) ?4,2

YOU'RE AT    3 RD STREET AND    2 ND AVENUE.
FOR A MAP TYPE '0,0'
WALK TO WHAT CORNER (ST.,AVE.) ?3,2
YOU'RE AT THAT CORNER NOW!
INPUT IGNORED.
FOR A MAP TYPE '0,0'
WALK TO WHAT CORNER (ST.,AVE.) ?2,2

YOU'RE AT    2 ND STREET AND    2 ND AVENUE.
FOR A MAP TYPE '0,0'
WALK TO WHAT CORNER (ST.,AVE.) ?0,0

& = YOU   :::: = FOOTPRINTS

      ***********
      * 1ST ST. *
      *         *
::::::&****************
:1   2: 2ND ST. *3   4*
:S   N:         *R   T*
:T   D: 3RD ST. *D   H*
:     ***********     *
:A   A:         *A   A*
:V   V:         *V   V*
:E   E: 4TH ST. *E   E*
:N    ::::::::::*******
:U              :
:E      5TH ST. :
:::::::::::::::::

WALK TO WHAT CORNER (ST.,AVE.) ?2,3

YOU'RE AT    2 ND STREET AND    3 RD AVENUE.
FOR A MAP TYPE '0,0'
WALK TO WHAT CORNER (ST.,AVE.) ?3,3

YOU'RE AT    3 RD STREET AND    3 RD AVENUE.
FOR A MAP TYPE '0,0'
WALK TO WHAT CORNER (ST.,AVE.) ?3,2

YOU'RE AT    3 RD STREET AND    2 ND AVENUE.
WANT FINAL MAP ?YES

& = YOU   :::: = FOOTPRINTS

      ***********
      * 1ST ST. *
      *         *
::::::*::::::::::******
:1   2: 2ND ST. :3   4*
:S   N:         :R   T*
:T   D: 3RD ST. :D   H*
:     &:::::::::*     *
:A   A:         *A   A*
:V   V:         *V   V*
:E   E: 4TH ST. *E   E*
:N    ::::::::::*******
:U              :
:E      5TH ST. :
:::::::::::::::::

YOU WERE SUPPOSED TO PATROL THE WHOLE VILLAGE!
TYPE RUN TO TRY AGAIN.

ready
```

Another new game from Creative Computing . . . .

DELMAR



Author: Ron Morgan and Kirk Roderick, Northridge, Calif.

Language: Fortran IV.
Description: See Listing.

```
                         DELMAR
130C
140C       THIS PRØGRAM SIMULATES A HØRSE RACE STRICTLY USING THE
150C       RANDØM FUNCTIØN.
160C
170C
180C       BY RØN MØRGAN, KIRK RØDERICK   12/02/74
190C       CSUN, 18111 NØRDHØFF STREET, NØRTHRIDGE  CA  91324
200C       THE DØUBLE PRECISIØN REALS, HØRSE AND JØCK, CAN HØLD A
210C       MAXIMUM ØF 16 ALPHA-NUMERIC CHARACTERS.  THE CØMMØN BLØCKS
220C       REFER TØ EACH ØF THE SUBRØUTINES WHICH ACCESS THEM.
230C
240C       HØRSE AND JØCK ARE DØUBLE PRECISIØN REAL ARRAYS THAT WILL
250C       HØLD THE NAMES ØF THE HØRSES AND JØCKEYS.  IHAND CØNTAINS
260C       THE HANDICAP THAT THE HØRSES WILL START AWAY FRØM THE
270C       FINISH LINE (FRØM 1 TØ 20).  IØDD IS THE ØDDS (-1) THAT
280C       WILL BE PRINTED ØUT (DIVIDES 40).  IHØRSE AND IMT CØNTAIN
290C       THE HØRSE NUMBER AND AMØUNT FØR EACH PLAYER'S BET.  IPLAY
300C       IS THE NUMBER ØF PLAYERS (1-5).  IBANK CØNTAINS THE AMØUNT
310C       ØF MØNEY EACH PLAYER HAS LEFT (INITIALIZED TØ 100).
320C       IWIN IS THE NUMBER ØF THE WINNING HØRSE.
330C
340C
350        PRØGRAM DELMAR
360        DØUBLE PRECISIØN HØRSE(5),JØCK(5)
370        CØMMØN /HØRSEY/ HØRSE,JØCK
380        CØMMØN /NUMØDD/ IHAND(5),IØDD(5)
390        CØMMØN /BET/ IHØRSE(5),IMT(5),IPLAY,IBANK(5),IWIN
490        CALL ESCAPE(8S)
500        CALL TIME(3,IHØURS,MINS)
510        IMINS=IHØURS*60+MINS
520        WRITE(1,3)
530 3      FØRMAT(30X,6HDELMAR,2/5X"PRØGRAM SIMULATES A HØRSE RACE
540       +BY USE ØF THE RANDØM FUNCTIØN",/)
550        WRITE(1,0)\,"DØ YØU WANT INSTRUCTIØNS? "
560        IANS=3H
570 4      READ(0,5) IANS
580 5      FØRMAT(A3)
590        IF (IANS.EQ.3HNØ ) GØ TØ 8
600        IF (IANS.EQ.3HYES) GØ TØ 6
610        WRITE(1,0)\,"PLEASE ANSWER YES ØR NØ: "
620        GØ TØ 4
630 6      WRITE(1,0)"THIS IS A SIMULATED HØRSE RACE.  THERE ARE 20"
640        WRITE(1,0)"HØRSES AND JØCKEYS IN THE STABLE.  YØU START"
650        WRITE(1,0)"ØUT WITH $100.  ØNLY WHØLE NUMBER AMØUNTS ARE"
660        WRITE(1,0)"ALLØWED IN BETS (I.E. 100 NØT 100.00)."
670        WRITE(1,0)"THERE IS A MAXIMUM ØF 5"
680        WRITE(1,0)"PLAYERS. THE HØRSES AND JØCKEYS FØR EACH RACE ARE"
690        WRITE(1,0)"PICKED RANDØMLY AS ARE THE ØDDS AND THE ACTUAL RAC
700       +E."
710        WRITE(1,0)"HØWEVER, THE ØDDS DØ HAVE A WEIGHT (ØR HANDICAP)"
720        WRITE(1,0)"IN THE ØUTCØME ØF THE RACE."
730 8      WRITE(1,0)\,"HØW MANY PLAYERS? "
740        READ(0,10) IPLAY
750 10     FØRMAT(I1)
760        IF (IPLAY.LE.5.AND.IPLAY.GT.0) GØ TØ 15
770        WRITE(1,0)"TØØ MANY PLAYERS.  MAXIMUM ØF 5."
780        GØ TØ 8
790 15     CALL ESCAPE(55S)
800        DØ 20 I=1,IPLAY
810        IBANK(I)=100
820 20     CØNTINUE
830 40     DØ 50 I=1,5
840        IHØRSE(I)=IMT(I)=IØDD(I)=IHAND(I)=0
850        HØRSE(I)=JØCK(I)=16H
860 50     CØNTINUE
870        CALL PICKS
880        CALL ØDDS
890        CALL BETS
900        CALL ESCAPE (0)
910        CALL RACE
920        CALL BANKER
930 55     IF SENSE LIGHT 1,67,56
940 56     WRITE(1,0)\,"DØ YØU WANT ANØTHER RACE? "
950        IANS=3H
960 60     READ(0,5) IANS
970        IF (IANS.EQ.3HYES) GØ TØ 65
980        IF(IANS.EQ.3HNØ ) STØP
990        WRITE(1,0)\,"PLEASE ANSWER YES ØR NØ: "
1000        GØ TØ 60
1010 65     CALL TIME(3,IHØURS,MINS)
1020        MINS=IHØURS*60+MINS-28
1030        IF (IMINS.GT.MINS) GØ TØ 40
1040        WRITE(1,0)"THIS IS YØUR LAST RACE: "
1050        SENSE LIGHT 1
1060        GØ TØ 40
1070 67     STØP
1080        END
1090C
1100C
1110C     SUBRØUTINE FØR PICKING HØRSES AND JØCKEYS
1120C
1130C      --RANDØM FUNCTIØN
1140C     THE RANDØM FUNCTIØN RETURNS A PSEUDØ-RANDØM NUMBER, R, WHERE
1150C     0<=R<1.  THERE ARE TWØ MØDES AVAILABLE:  REPRØDUCIBLE AND
1160C     NØN-REPRØDUCIBLE.  THE ARGUMENT SELECTS THE MØDE.
1170C
1180C                                             MØDE ØF         MØDE ØF
1190C     NAME       FUNCTIØN                     ARGUMENT        RESULT
1200C
1210C     RANDØM(I)  NEXT PSEUDØ-RANDØM VALUE     INTEGER         REAL
1220C
1230C
1240C     IF I IS NEGATIVE, THE GENERATØR IS SET BACK TØ THE BEGINNING
1250C     ØF ITS REPRØDUCIBLE SEQUENCE.  THE RESULT, R, WILL BE THE SAME
1260C     AS THE FIRST TIME RANDØM IS CALLED AFTER LØADING.  IF I IS
1270C     ZERØ, THE NEXT NUMBER IN THE REPRØDUCIBLE SEQUENCE IS RETURNED
1280C     AS THE RESULT.  IF I IS GREATER THAN ZERØ, AN INDEFINITE
1290C     NUMBER (FRØM 0 TØ 63) ØF THE NEXT SEQUENTIAL INTERMEDIATE
1300C     12-BIT VALUES ARE SKIPPED BEFØRE THE RANDØM NUMBER IS
1310C     CØNSTRUCTED.  THE NUMBER ØF VALUES SKIPPED IS DETERMINED BY THE
1320C     LEAST SIGNIFICANT PØRTIØN ØF THE CURRENT VALUE ØF THE REAL-
1330C     TIME CLØCK IN THE CØMPUTER.
1340C
1350C
1360C     THE RANDØM NUMBERS ARE CØNSTRUCTED FRØM THREE 12-BIT GRØUPS
1370C     CALCULATED FRØM 5**(2*N+1)  (MØD 2**39), USING THE LEFT-MØST
1380C     12-BITS.
1390C
1400C        J AND L ARE THE NUMBERS THAT ARE CHØSEN RANDØMLY THAT
1410C        CØNTRØL THE HØRSE(J) AND JØCKEY8L) THAT ARE CHØSEN.
1420C        H AND JØ ARE DEFINED IN DATA AS THE HØRSES(H) AND JØCKEYS(JØ)
1430C        THE CHECK TØ SEE IF THE HØRSE(ØR JØCKEY9 WAS ALREADY CHØSEN
1440C        STARTS AT 90.
1450C
1460           SUBRØUTINE PICKS
1470           DØUBLE PRECISIØN HØRSE(5),JØCK(5),H(20),JØ(20)
1480           CØMMØN /HØRSEY/ HØRSE,JØCK
1490           DIMENSIØN J(5),L(5)
1500           DATA H /16HACK ACK          ,16HØVERGLØRY
1510          +16HTIMETØLIGHT     ,16HGØLDEN WALLET    ,16HRAVISHING RUBY     ,
1520          +16HRED RUNNING GØØD,16HACRØCYANØSIS     ,16HNADINE MALCØLM     ,
1530          +16HWHØØPEE         ,16HSHAMALEEN        ,16HMISS ALERT         ,
1540          +16HCØMMAND PRINCE  ,16HIRØNSIDE         ,16HWILD SURF          ,
1550          +16HCANNØNERØ II    ,16HDAMAGE CØNTRØL   ,16HSHIEK KAMIAKIN     ,
1560          +16HAUDACITY        ,16HCØURT CLØWN      ,16HSWEET ANASTACIA    /
1570           DATA JØ /16HKSINNER         ,16HGBAZE
1580          +16HJLEØNARD        ,16HSHØEMAKER        ,16HJTGØNZALEZ         ,
1590          +16HSGØLDSMITH      ,16HMLEWIS           ,16HRYAKA              ,
1600          +16HWDELIA          ,16HAØCHØA           ,16HGLAWLESS           ,
1610          +16HPINEDA          ,16HMRUJANØ          ,16HKFURLØNG           ,
1620          +16HSARCHULETA      ,16HMUALENAUELA      ,16HJWILBURN           ,
1630          +16HFMENA           ,16HSVALDEZ          ,16HPEREZ              /
1640           CALL ESCAPE (0)
1650 70        DØ 120 I=1,5
1660 80        J(I)=IFIX(RANDØM(5)*20)
1670           L(I)=IFIX(RANDØM(5)*20)
1680           IF(J(I)=0.ØR.L(I)=0) GØ TØ 80
1690           IF (I.EQ.1) GØ TØ 105
1700 90        DØ 100 L2=1,I-1
1710           IF(J(I)=J(L2).ØR.L(I)=L(L2)) GØ TØ 80
1720 100       CØNTINUE
1730 105       HØRSE(I)=H(J(I))
1740           JØCK(I)=JØ(L(I))
1750 120       CØNTINUE
1760           RETURN
1770           END
1780C
1790C
1800C      SUBRØUTINE FØR DETERMINING ØDDS
1810C
1820C         THE ØDDS ARE DETERMINED BY HAVING 40 DIVIDED BY THE
1830C         HANDICAP.  THIS PRØDUCES THE ØDDS FRØM 2-1 TØ 40-1.
1840           SUBRØUTINE ØDDS
1850           CØMMØN /NUMØDD/ IHAND(5),IØDD(5)
1860           CALL ESCAPE (0)
1870           DØ 150 I=1,5
1880 130       IHAND(I)=IFIX(RANDØM(5)*20)
1890           IF (IHAND(I).LE.0) GØ TØ 130
1900 140       IØDD(I)=IFIX(40/IHAND(I))
1910 150       CØNTINUE
1920           RETURN
1930           END
1940C
1950C
1960C      SUBRØUTINE FØR TAKING BETS
1970C
1980C         IF THE PLAYER DØES NØT HAVE ANY MØRE MØNEY (IBANK=0)
1990C         THEN THAT PLAYER DØES NØT GET A CHANCE TØ BET AND THE
2000C         AMØUNT ØF THE BET IS PUT TØ 0 (IMT=0).
2010C
2020           SUBRØUTINE BETS
2030           DØUBLE PRECISIØN HØRSE(5),JØCK(5)
2040           CØMMØN /HØRSEY/ HØRSE,JØCK
2050           CØMMØN /BET/ IHØRSE(5),IMT(5),IPLAY,IBANK(5),IWIN
2060           CØMMØN /NUMØDD/ IHAND(5),IØDD(5)
2070           CALL ESCAPE (0)
2080           WRITE(1,160)
2090 160       FØRMAT(1X,3/,1X"#",6X,"HØRSE"12X"JØCKEY"22X,"ØDDS",/)
```

```
      DØ 180 I=1,5
      WRITE(1,170) I,HØRSE(I),JØCK(I),IØDD(I)
  170 FØRMAT("(",I1,")",5X,A16,1X,A16,12X,I2,"-1")
  180 CØNTINUE
      WRITE(1,190)
  190 FØRMAT(\,1X,3/"TYPE THE NUMBER ØF THE HØRSE, THE AMØUNT ØF
     + THE BET.")
      DØ 220 I=1,IPLAY
      CALL ESCAPE (195S)
      IF (IBANK(I).LE.0) GØ TØ 217
  195 WRITE(1,200) I
  200 FØRMAT(\,1X,/,"PLAYER # "I1,1X)
      READ(0,0) IHØRSE(I),IMT(I)
      IF (IHØRSE(I).LE.5.AND.IHØRSE(I).GT.0) GØ TØ 215
      WRITE(1,0)"NØ SUCH HØRSE #."
      GØ TØ 195
  215 IF (IMT(I).LE.IBANK(I).ØR.IMT(I).LT.0) GØ TØ 220
      WRITE(1,0)"YØU DØN'T HAVE THAT MUCH MØNEY.  ENTER HØRSE #,
     +AND BET."
      GØ TØ 195
  217 IMT(I)=0
  220 CØNTINUE
      RETURN
      END
C
C
C    THIS SUBRØUTINE RUNS THE RACE INTERNALLY AND PRINTS THE RESULTS
C
C     IBELL CØNTAINS ALL G'S SØ THAT THE BELLS CAN BE ØUTPUT
C     USING THE C FØRMAT.  THE RACE IS RUN BY ADDING A RANDØM
C     NUMBER (FRØM 0-5) TØ THE ACCUMULATED TØTAL AND THE
C     HANDICAP (IHAND).  WHEN ØNE HØRSE CRØSSES THE FINISH LINE
C     (IHAND>=60) THE RACE ENDS AND THE RESULTS ARE PRINTED TØ
C     SHØW WHERE EACH HØRSE WAS WHEN THE WINNER CRØSSED THE
C     FINISH LINE.
C
      SUBRØUTINE RACE
      CØMMØN /BET/ IHØRSE(5),IMT(5),IPLAY,IBANK(5),IWIN
      CØMMØN /NUMØDD/ IHAND(5),IØDD(5)
      DØUBLE PRECISIØN IBELL
      CALL ESCAPE (0)
      WRITE(1,0)"AT THE SØUND ØF THE BELL THEY'RE ØFF."
      DØ 230 I=1,10000
  230 CØNTINUE
      IBELL=10HGGGGGGGGGG
      WRITE(1,233) IBELL
  233 FØRMAT(\,C10)
  235 DØ 240 I=1,5
      IHAND(I)=IHAND(I)+IFIX(RANDØM(5)*5)
  240 CØNTINUE
      DØ 245 I1=1,5
      IF (IHAND(I1).GE.60) GØ TØ 250
  245 CØNTINUE
      GØ TØ 235
  250 IWIN1=IHAND(1)
      DØ 260 I=1,5
      IWIN1=MAX0(IWIN1,IHAND(I))
  260 CØNTINUE
      DØ 265 I=1,5
      IF(IWIN1.EQ.IHAND(I)) IWIN1=I
  265 CØNTINUE
      WRITE(1,267)
  267 FØRMAT(49X," FINISH LINE^")
      IWIN=IWIN1
      WRITE(1,0) "HERE ARE THE RESULTS:"
      DØ 290 I=1,5
      WRITE(1,270) I
  270 FØRMAT(\,"(",I1,")")
      DØ 280 N=1,IHAND(I)-1
      WRITE(1,0)\,"-"
  280 CØNTINUE
      WRITE(1,0) "*"
  290 CØNTINUE
      RETURN
      END
C
C
C    THIS SUBRØUTINE KEEPS A RECØRD ØF WINS AND LØSSES.
C
C     THE BANK TØTALS ARE DETERMINED BY WHETHER THE PLAYER
C     CHØSE THE WINNER.  IF A BANK BALANCE BECØMES GREATER
C     THAN 9999 THE PRØGRAM ENDS AND PRINTS ØUT A MESSAGE,
C     ØR IF ALL THE PLAYERS RUN ØUT ØF MØNEY ANØTHER MESSAGE IS
C     PRINTED ØUT.
C
      SUBRØUTINE BANKER
      CØMMØN /BET/ IHØRSE(5),IMT(5),IPLAY,IBANK(5),IWIN
      CØMMØN /NUMØDD/ IHAND(5),IØDD(5)
      CALL ESCAPE (0)
      WRITE(1,300) IWIN
  300 FØRMAT(1X/"HØRSE #",I1," WØN."/"HERE ARE YØUR BANK BALANCES:")
      I1=I2=0
      DØ 340 I=1,IPLAY
      IF(IHØRSE(I).EQ.IWIN) GØ TØ 310
      IBANK(I)=IBANK(I)-IMT(I)
      GØ TØ 320
  310 IBANK(I)=IBANK(I)+IMT(I)*(IØDD(IWIN))
  320 WRITE(1,330) I,IBANK(I)
  330 FØRMAT(1X,/"PLAYER #",I1," $ ",F7.2)
      IF (IBANK(I).GT.9999) SENSE LIGHT 2
      IF(IBANK(I).LE.0) I2=I2+1
  340 CØNTINUE
      IF SENSE LIGHT 2,350,345
  345 IF(I2.GE.IPLAY) GØ TØ 360
      RETURN
  350 WRITE(1,0)"YØU HAVE BRØKEN THE BANK!!!!!"
      STØP
  360 WRITE(1,0)"YØU ALL RAN ØUT ØF MØNEY.  PLEASE PAY THE"
      WRITE(1,0)"CASHIER WHEN YØU EXIT.  THANK YØU."
      STØP
      END
```

SAMPLE RUN

```
                               DELMAR

     PROGRAM SIMULATES A HORSE RACE BY USE OF THE RANDOM FUNCTION

DO YOU WANT INSTRUCTIONS? NO
HOW MANY PLAYERS? 2



 #      HORSE            JOCKEY                       ODDS

(1)     DAMAGE CONTROL   GLAWLESS                     4-1
(2)     GOLDEN WALLET    JWILBURN                     8-1
(3)     WHOOPEE          SARCHULETA                   2-1
(4)     COMMAND PRINCE   JTGONZALEZ                   5-1
(5)     WILD SURF        JLEONARD                    13-1


TYPE THE NUMBER OF THE HORSE, THE AMOUNT OF THE BET.
PLAYER # 1 2,10.00

PLAYER # 2 3,50.00
AT THE SOUND OF THE BELL THEY'RE OFF.
                                                  FINISH LINE↑
HERE ARE THE RESULTS:
(1)---------------------------------------------------*
(2)----------------------------------------*
(3)---------------------------------------------------------------*
(4)----------------------------------------*
(5)--------------------------------------------------*

HORSE #3 WON.
HERE ARE YOUR BANK BALANCES:

PLAYER #1 $   90.00

PLAYER #2 $  200.00
DO YOU WANT ANOTHER RACE? YES



 #      HORSE            JOCKEY                       ODDS

(1)     WHOOPEE          MLEWIS                      20-1
(2)     OVERGLORY        KSINNER                      6-1
(3)     ACROCYANOSIS     SVALDEZ                      2-1
(4)     ACK ACK          MRUJANO                      3-1
(5)     AUDACITY         MUALENAUELA                 40-1


TYPE THE NUMBER OF THE HORSE, THE AMOUNT OF THE BET.
PLAYER # 1 3,33.28

PLAYER # 2 4,25.00
AT THE SOUND OF THE BELL THEY'RE OFF.
                                                  FINISH LINE↑
HERE ARE THE RESULTS:
(1)-------------------------------------*
(2)------------------------------------------------*
(3)------------------------------------------------------------*
(4)------------------------------------------------------*
(5)---------------------------------------------------------*

HORSE #3 WON.
HERE ARE YOUR BANK BALANCES:

PLAYER #1 $  156.00

PLAYER #2 $  175.00
DO YOU WANT ANOTHER RACE? YES



 #      HORSE            JOCKEY                       ODDS

(1)     COURT CLOWN      JWILBURN                     4-1
(2)     WHOOPEE          SVALDEZ                      2-1
(3)     WILD SURF        GBAZE                        4-1
(4)     SHIEK KAMIAKIN   AOCHOA                       4-1
(5)     TIMETOLIGHT      SARCHULETA                   3-1


TYPE THE NUMBER OF THE HORSE, THE AMOUNT OF THE BET.
PLAYER # 1 5,30.00

PLAYER # 2 2,50.00
AT THE SOUND OF THE BELL THEY'RE OFF.
                                                  FINISH LINE↑
HERE ARE THE RESULTS:
(1)--------------------------------------------*
(2)-----------------------------------------------------*
(3)-------------------------------------------------*
(4)-------------------------------------------------*
(5)-------------------------------------------------------------*

HORSE #5 WON.
HERE ARE YOUR BANK BALANCES:

PLAYER #1 $  246.00

PLAYER #2 $  125.00
DO YOU WANT ANOTHER RACE? YES
```

Creative Computing Compendium

This section of *Creative Computing* consists of news, notes, quotes, and short bits about this computer age in which we live. It was compiled and edited by Trish Todd, a freshman at Brown University along with David Ahl.

Did this really happen?

Perhaps it happened at Cornell. In an electrical engineering lab a young instructor was desperately trying to organize the first day's work. A freshman came up to him and said, "There's no power at my lab station."

"Sure there is," said the instructor. "I checked them all myself."

"No, there isn't," insisted the student.

"Go test it!"

"I don't have any voltmeter."

"You don't need a voltmeter. Just brush the backs of your fingers across the terminals. It'll bite, but it won't hurt you."

The kid backed off, looking mighty skeptical. A minute later there was a blinding flash in that corner of the lab and breakers popped open all over the place. By the time the instructor got to the bench he found the molten remains of a Stillson wrench hanging from the terminals and the kid backing off, crying, "My God, my God, what if it had been me?"

Clifford Swartz
The Physics Teacher

Computer on Ice

To computerize, or not to computerize? That is the question as the time worn tug-of-war between man and machine gets an athletic yank.

Raymond Epich, a hockey enthusiast and vice president with the Chicago office of Cresap, McCormick and Paget, Inc., management consultants, has applied for a patent for an electronic tracking system to produce computerized hockey statistics in profusion enough to make even a baseball sigh.

The experimental system consists of an electronic grid underneath the rink, plus transmitting devices in the puck and players' skates and sticks that would allow the computer to produce instant readouts of such statistics as the velocity of a shot, the speed of a given player, which players spend the most time on the ice and on and on.

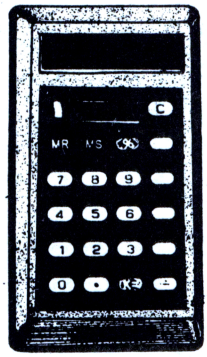
"In hockey you really have only three or four basic statistics," says Mr. Epich, which does not give the hockey freak much to discuss during the off season.

One ardent fan said he would "love to see the idea implemented." But he noted, most fans are skeptical about new ideas that might disrupt the game.

A spokesman from the World Hockey Association in Toronto said statistics "rarely help sell tickets."

"They're talking about big dollars," he added. Mr. Epich readily agrees, giving a ballpark figure of $1-million per stadium to cover costs for implementation. Still, he says he has received some 30 inquiries about the system.

NY Times



Calculators at Work

POCKETCALCULATORS affect work from the executive suite to the classroom.

"You'll find them in more attache cases today than socks or underwear," declares James J. Brown, a Walter Kidde & Co. senior executive. He's able to answer financial questions immediately instead of telling his boss, "I'll be back to you on that." The noise level at AMF Inc.'s headquarters drops sharply as "mechanical monsters" are replaced with the small, quiet devices.

Harris Corp. Chairman Richard B. Tullis uses his pocket calculator daily to figure percentage changes, rates of return and growth rates. An Atlanta Pontiac dealer finds customers whipping out calculators to double-check salesmen's arithmetic. Some college quizzes grow longer as teachers discover students completing work more quickly.

But one Detroit bank executive complains, "I just can't add three- or four-digit numbers in my head" since starting to use a pocket calculator.

Wall St. Journal

But Who Will Read It?

IBM has introduced a laser printer that operates at six times the speed of its currently available hardware. The IBM 3800 will print up to 13,360 lines per minute on plain paper, and be available in the third quarter of 1976. Operating like an "office copier", it will not require supplies like ribbons and carbon paper, and will be able to reproduce form designs on blank paper. Multiple copies will be produced faster than older printers can produce single copies.

The Computerized Eye Doctor

Remember your last eye test? The optometrist changed the eye chart you had memorized, caught you squinting, and then thoroughly confused you by changing lenses before your eyes and asking "Is this better?" or "Is that better?" You started wondering if you could see at all. Well, all that is going to be part of history soon according to the American Optometric Association. The technology that brought us pocket computers is bringing small computerized diagnostic equipment into optometrists' offices. The new phenomenon is called electrodiagnosis.

Before too long, you will sit down in the optometrist's office and let a computer "read" what your brain is "seeing" (the eye collects data and sends it to the brain, where we actually see). Three electrodiagnostic vision tests developed at the University of Houston College of Optometry are already available on a limited basis:

o VER, or visual evoked response. VER is a test used to objectively measure the refractive state of the eye. Today it is being used to examine the vision of small children, retarded persons, the deaf, and others who cannot respond to subjective tests of their vision.

o ERG, or electroretinogram. ERG records electrical responses directly from the eye's retina, the ten-layered inner lining of the eye, and far surpasses the current method of diagnosis, which involves using an instrument called the opthalmoscope to look at the retina through the pupil. Many eye surgeons now rely on ERG to aid them in determining whether or not cataract surgery should be undertaken.

o EOG, or electro-oculogram. EOG records eye movements and helps the optometrist determine, for instance, if a child can accurately and smoothly move his eyes when switching his view from blackboard to desk.

When will the new tests be available? Within the next year or two, claims the American Optometric Association, group practices will be using computerized equipment routinely.

Science Digest

Science IQ Dropping Fast

Can you answer these science questions?

1) In terms of the story of natural selection, what is the explanation of why giraffes have come to have such long necks?

a. Stretching to get food in high trees has made their necks longer.
b. There is something inside of giraffes which keeps making longer necks.
c. Giraffe food contained vitamins which caused the vertebrae to lengthen.
d. Giraffe necks have gotten longer and longer as time has gone on, but nobody has any idea why this is.
e. Giraffes born with the longest necks have been able to stay alive when food was scarce and have passed this trait on to their offspring.

2) Which of the following is good evidence for concluding that glaciers once covered Canada?

a. Rocks containing melted ice have been found throughout Canada.
b. Radioactive decay of uranium in Canadian rocks has been measured.
c. Scratches on surface rocks in Canada look like scratches made by known glaciers.
d. Only glaciers could have formed the high Canadian mountains.
e. Canada has a cold climate which glaciers need in order to keep from melting.

3) What device changes the voltage of an electric power supply?

a. alternator.
b. battery.
c. rectifier.
d. transformer.

4) Of the following, which is the most direct cause of the tides on earth?

a. The tilt of the earth's poles.
b. The magnetic field of the earth.
c. The slope of land near the shoreline.
d. The revolution of the earth about the sun.
e. The effect of the moon's gravitational pull on earth.

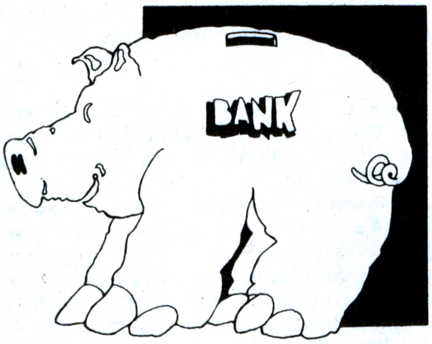
The correct answers are: 1) e; 2) c; 3) d; and 4) e. If you answered the giraffe question correctly, you did as well as 53 per cent of the 17-year-olds asked the question in a recent national survey directed by the National Assessment of Educational Progress (NAEP). If you answered the glacier question correctly, you did better than most 17-year olds; only 38 per cent answered it correctly. If you answered the energy question correctly, you did as well as 46.6 per cent of the 17-year-olds. And if you answered the last question correctly, you agreed with 41.9 per cent of a younger group, 13-year-olds.

NAEP asked science questions about biology, chemistry and physics of 90,000 students ages 9, 13 and 17 during the 1972-73 school year. The results show science knowledge has declined since 1969-70, the last year NAEP made the survey. There was a drop in all age groups but the oldest students showed the sharpest decline. Rural students did better, while big city students and suburban students did worse. Big city students showed the greatest decline. The performance of males and females dropped at all ages, but boys did better than girls and the older the students, the lower the girls' scores compared to boys.

NAEP project director J. Stanley Ahmann doesn't know why science knowledge is declining among students, but he speculates that the better performance in 1969-70 may have been due to the emphasis given science education in the wake of Sputnik.

Science Digest

The Grants Data Bank



The newest and most efficient instrument to match the interests of those seeking funds with those granting funds is the Grants Data Bank.

Take, for example, a grant to bring more bluebirds back to New York. The words "bird life" are fed into the bank, and after 90 seconds of polite whirring the computer prints out five grants. (With electronic thoroughness, the computer also prints out a grant to Blue Bird Circle in Houston to construct a new outlet store.) A name such as "Audubon" would undoubtedly have turned up more possibilities!

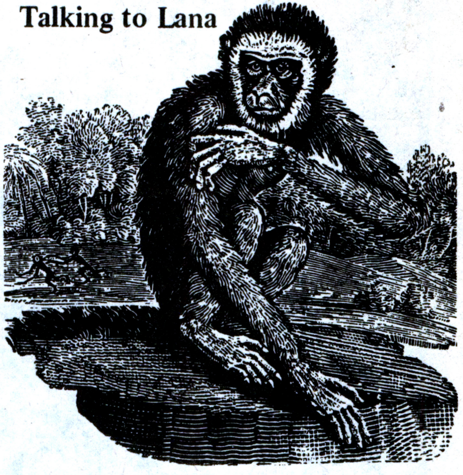
The price for a search (which can be arranged by mail) is $15 for up to 50 grant records and 20¢ for each grant record thereafter. For a broad field such as health, education or conservation, specify the maximum expenditure and narrow the field as much as possible. For example, specify only those 15 foundations that have the largest grant programs for a given field.

For more information contact: The Foundation Center, 888 Seventh Avenue, New York, NY 10019.

Automatic Checkbook Balancing

A checkbook that includes a built-in calculator will be offered soon by the Chase Manhattan Bank. Manufactured by Mostek Corp. of Dallas, TX, the unit can add and subtract and has a constant memory for the balance that is not erased even when the unit is turned off. Similar units are being rushed to market by other manufacturers of pocket calculators.

Talking to Lana



A computer has become the means of communication between Lana, a four-year-old chimpanzee, and the rest of the world. Two years ago, she started to use the symbols on a computer key board to talk to her keepers. Lana quickly mastered about forty words, and now, she is able to use about seventy-five word symbols and is asking to learn more. She has begun to ask her trainers the names of various objects. Lana's ability to learn a language suggests that the mental ability of chimpanzees may have been underestimated. Researchers at the Yerkes Regional Primate Research Center in Atlanta, where Lana is being trained, say that the methods used to teach Lana may eventually be used to help mentally retarded or disturbed children who have trouble learning to communicate.

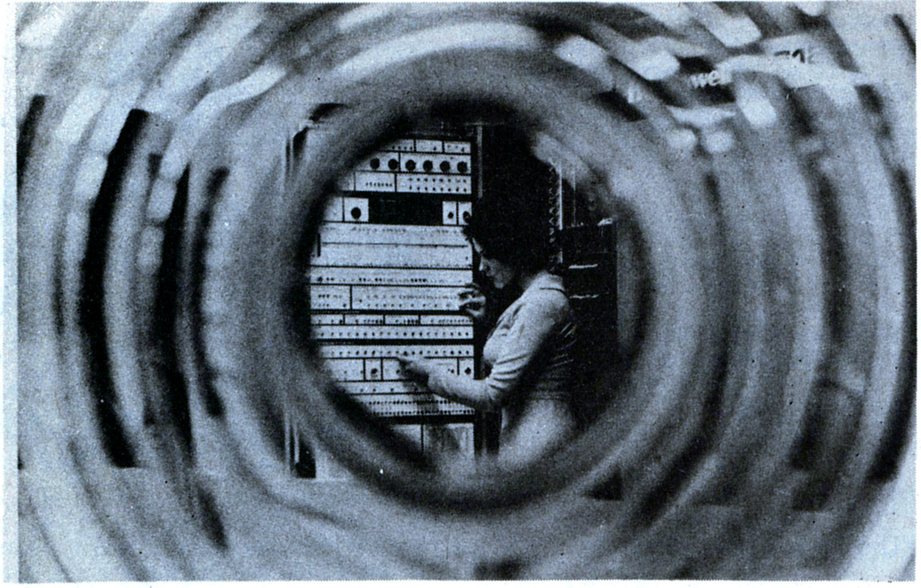
Science News

Opportunities for the Deprived

A computer has helped 600 educationally, physically, and economically handicapped people find vocational or educational training that met their specific needs. This computer is part of a program called Computer Based Educational Opportunity Center, sponsored by the City University of New York and located at the Henry Street Settlement House.

Programmed with more than 500 academic and training sources in all five boroughs, the computer can find a workable solution to fit the special needs of most people. It has, for example, found a key punch operator training center for a handicapped veteran with a child who needed day care services, a woman who wanted a career in carpentry, and a man who could only spend $500 a year for his education to become a chemical engineer.

There are five counseling computers in New York; however, four are at colleges, and Henry Street is the only social agency using the program. The computer terminal is small, so it is easy to transport it to other New York neighborhoods. The program may well become a vital resource in bringing education and careers to low income people.



"Rings of Protection" in Honeywell's advanced Multics computer system.

Multics Provides Power, Protection

In the early part of 1973, Honeywell, Inc. introduced the Multiplexed Information and Computing Service (Multics) to the commercial market.

The Multics project began in 1965 and was funded by the Advanced Research Projects Agency of the Department of Defense. Research was conducted by the Massachusetts Institute of Technology's Project MAC, Bell Telephone Laboratories and General Electric. In 1969, Bell Labs terminated its participation, and General Electric sold its computer business to Honeywell in 1970.

The result was the Multics system, based on Honeywell's 6000 series of large-scale computers. It features a ring protection system, software which is free of core memory restraints and any particular hardware configuration, and "the most powerful virtual memory system yet available." The resources of the system are available to any user on demand.

The ring protection system offers maximum security and privacy. A user can allow a "guest" to use the system, but the method and condition of access are established only by the owner of the requested file.

However, Multics' most attractive feature is that it is a general-purpose system which is able to efficiently serve a large community of users with diverse needs. It provides the most cost-effective environment for problem solving because of its flexible nature. With the introduction of Multics began an era of measuring a computer's efficiency by its problem solving abilities instead of in terms of its memory size, speed, or cost.

A typical small Multics configuration would include one 6180 central processor (an enhanced version of the company's 6080), 192,000 words of main memory, one million words of bulk core storage, 200 million bytes of disk storage, one input/output multiplexor, one Datanet 355 communications processor, five tape units, a card reader, card punch and printer, plus terminals. Purchase price of this configuration would be $3,565,000.

Smart Kid

When he was fourteen years old, David Touretzky of Edison, N. J. decided that he would like to learn about computer science. Now, at age fifteen, he has written a one hundred page manual on the subject, learned over a dozen computer languages, and this spring, taught a three day seminar on a computer language known as BASIC at Kean College.

David earned enough money from babysitting and mowing lawns to buy the books and manuals he needed to teach himself computer science. He then wrote his own manual for others who would like to teach themselves. The book is now in its second printing by E.I.S. Press and is sold in college bookstores throughout New Jersey.

David is now developing Computer Based Resource Units at Educational Information Services (EIS), for which he has technical responsibility. These resource units will provide media and references for biology and ecology teachers. Last year, David wrote programs for the business computers at Philips Data Systems of Union, a division of North American Philips Corporation.

David hopes to skip his senior year at Edison High School and go on to Rutgers. After he reaches his eventual goal of a Ph.D. in computer research, he would like to work with computers and artificial intelligence.

Computers in Medieval Days?

Finding evidence for historical analysis is rarely easy, particularly for periods in time that left us with few records, such as the Middle Ages. History has always pictured the Middle Ages as a time of glamorous chivalry and feudal wealth. However, with the aid of a computer, a census called *Roles des fiefs* (list of estates), taken of a territory in thirteenth century France, has shed a completely different light on this period.

The census was a record of the economic and social situations of 1,182 persons who held lands from Count Thibaut IV de Chansonnier of Champagne. Quantification by the computer showed that feudal lords, who owned huge castles, had judicial and taxation rights, and had fief-holders of their own, were a distinct minority. The usual aristocrat had a small income and lived modestly, as other rural farmers did. The majority of these aristocrats were knights, rewarded only with a title for defending their faith and their lord's lands and ladies.

Previous medieval social history has been drawn from charter evidence and ecclesiastical property records. But Professor Theodore Evergates of Western Maryland College offers the findings of the computer as a corrective to the traditional picture of the medieval society.

Computers in Crime Labs

The Bank of America building in Santa Barbara, California is bombed, and a computer arrives on the scene, peering through a magnifying glass and sprinkling dust for fingerprints. Yes, Data General Corporation's Nova 1200-based system minicomputer has been helping the Treasury Department's Bureau of Alcohol, Tobacco, and Firearms Crime Laboratory solve this crime and others similar to it.

One of the Nova systems played a major part in solving the bombing in Santa Barbara. A ceiling tile containing bomb fragments and unburned explosives, a pipe from the suspect's garage, and soil from his shoes were taken to the ATF Laboratory. There, the material was chemically treated and exposed to radiation in a nuclear reactor. The pulse height analysis proved the fragments in the ceiling tile were made up of the same material as the pipe from the suspect's garage, and that the soil from the shoes matched soil from around the bank. These results were used as evidence in court, and the suspect was indicted.

Nova computers also process gunshot cases by checking swabs from a suspect's hand for components of gunshot residue. The facilities in the Crime Laboratory are available to any Law Enforcement Agency in the United States.

Lost? Get a Computer

Computers have helped man gather billions of pieces of information, classify them, and file them. However, when studying large amounts of data, it is hard for man to make comparisons, establish relationships, and solve problems. Through graphics and mapping techniques, computers can organize data into formats that will help man deal with data more efficiently and effectively.

A popular method of mapping has been shaded area mapping. It is a computerized way of drawing a map and coloring in different areas according to the given qualifications. However, because computers use digitized formats, it is hard to program an area that is not rectangular, such as a country, city, or county. It is also difficult to compare and combine data using the shaded area mapping; the resulting area hides its elements.

A new approach to the problem of computer mapping has emerged called symbol maps. Symbol maps pose no restriction on the amount of data to be displayed or the design of the symbols. The two types of plotted symbols used most often are the circle/square symbol and a focus indicator symbol. When using the circle/square symbol, the square acts as a universe, and the circle is a subset. The square may also be divided vertically or horizontally, and circles can interlink. The focus indicator symbol is a circle divided into arc fans. The size and number of the fans are easily adjustable and can be determined by the given data.

Both the circle/square and focus indicator symbols will become more familiar to the public as their use is increased and perfected. These two methods of mapping will continue the computer's job of helping man gather data to solve problems.

Worthless Information Department

For those people lucky enough to have Texas Instruments SR-22 calculators:

1) Turn on calculator.
2) Set to 'manual'.
3) Change base to Decimal.
4) Punch in 4 444 444 (seven 4s).
5) Hit the HEX conversion key eight times, leaving the calculator in DECIMAL. After the eighth HEX conversion the display will not come back — congratulations! Your SR-22 is in an endless loop. The *only* way to clear it is to turn the calculator off and then on again.

I know this works on at least two SR-22s, so it probably works on all of them. I haven't the faintest idea why this happens — the machine does funny things on repeated hex conversions in decimal mode. Someday I'll get around to writing T.I. and asking them.

Don't ask me how I discovered this. *I* don't know how I discovered it. I just like to punch buttons and play with things. Call it Creative Insanity exemplified.

John Lees
Rolla, MO

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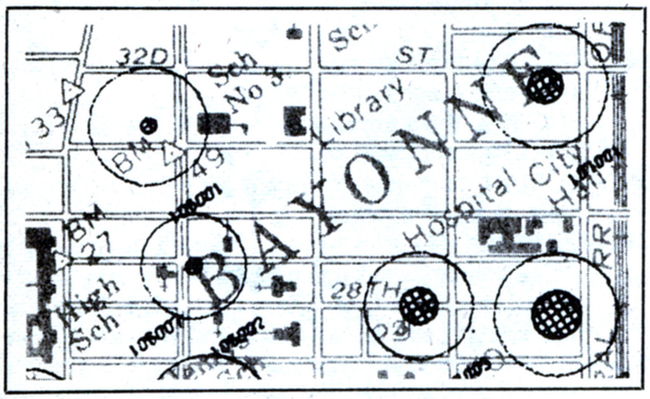
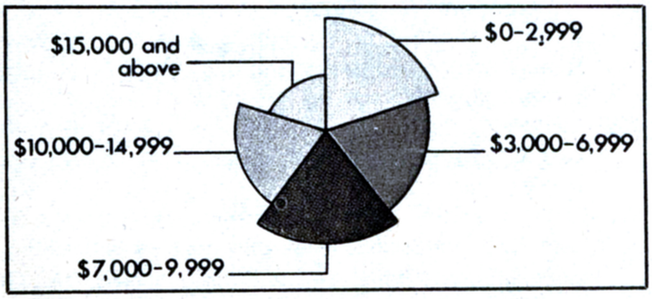


The circle symbols on this map show the distribution of school age children. The full circle shows the total number; the shaded area, children in low-income families.



The focus indicator is a powerful tool for display when data elements and map options are chosen carefully.

WORLD'S LARGEST CHECKOUT

Canton Central Township, Michigan — The world's largest checkout system has been installed in a Meijer, Inc., superstore in this suburban community 30 miles west of Detroit. Shown above are some of the giant store's 58 checkout lanes. There are another 31 checkout stations in separate departments throughout the store. The half-million-dollar electronic checkout system includes, in addition to 89 NCR 255 checkout terminals, four NCR 726 in-store computers which control the operation of the system.

> **"As soon as you can say what you think and not what some other person has thought for you, you are on the way to being a remarkable man."**
>
> **James M. Barrie**

Talk, Type, and Now Write Over Telephone Lines

Scientists at Bell Telephone Laboratories have developed a video system that transmits handwriting, reproduces pictures, and can be used to communicate directly with a computer. The new system is a step forward in improving interaction between people and machines.

The system consists of a commercially available plasma panel display (modified by Bell Labs), electronic control circuitry, and a special light pen.

The panel is made of thousands of tiny neon-gas cells which glow when energized by an electric current. These glowing cells may be turned on and off selectively to produce images; an image may be sent from far away if the correct instructions are given over a telephone. If two panels are connected, "writing" on one panel with the light pen will produce the image on the other panel. The tone of the dots in the images may also be varied by changing the density of the cells that have been charged. This quality is essential for truthful reproductions.

The system is still being developed, but some potential, practical uses of the system have already been proven. The system can:

- record a person's signature and display it on command
- reproduce pictures and charts at the rate of a few per minute
- display a list of telephone numbers and simulate dialing the number pointed to with the pen
- serve as a desk top calculator
- display the time and date on command.

Bell Labs Contributions to Digital Computer Technology

Efficiency is one major benefit of the computer, and as the operation of a corporation becomes more complex, detailed, and time-consuming, it frequently is possible to design computer systems to cope with these problems. For example, Bell Telephone Laboratories have designed a computer system for telephone repair service. LMOS, the Loop Maintenance Operating System, allows local Telephone Company repair service bureaus to make automatic tests, under minicomputer control, of customer lines. The minicomputers have access to data stored in a large computer in another location. Often, trouble can be diagnosed almost instantly. LMOS, introduced in January 1975, is one of the most recent developments by Bell Labs in their long history of contributions to digital computing technology.

HIGHLIGHTS OF BELL LABS' CONTRIBUTIONS TO DIGITAL COMPUTING TECHNOLOGY

1937—Application of Boolean algebra to the design of logic circuitry.

1939—Complex Number Calculator (Model I Relay Computer)—the first electrical digital computer built of relays.

1941—OR circuit.

1942—AND circuit.

1943—Model II Relay Computer—produced punched paper tapes for dynamic tests on fire-control equipment. Included error-checking capability.

1944—Model III—relay computer for fire-control problems. Could hunt through paper tapes for address of a block of data.

1945—Model IV—relay computer for fire control problems for ship-mounted guns. Could calculate trigonometric functions.

1946—Model V—general purpose relay computer with two processors, permanently wired math tables, floating decimal point, conditional transfer capability.

1948—AMA (Automatic Message Accounting)—relay computer for extracting billing information from phone calls.

1949—Transistorized gating circuitry.

1950—Model VI—last of line of relay computers. Solved telephone R&D problems. Had automatic second-trial feature, useful for unattended operation.
Air-cushioned magnetic recording head. Widely applied in commercial drum and disk storage systems.

1956—L1 and L2 (also known as Bell 1 and Bell 2) allowed users to communicate with computers in a language far simpler than basic machine language.

1959—Leprechaun. Had 5500 transistors and 18,000 memory cores in 15 cu. ft. volume. Ran on 160 watts.
Macro instructions; allowed programmers to add terms not included in the original programming language.

1960—TPLOT, programs for producing computer-generated plots and graphs on microfilm.
SNOBOL, a programming language for manipulating strings of characters.

1961—ALTRAN, language for making symbolic computations on algebraic data.

1963—GRAPHIC 1 system allowed user to communicate with a computer through a cathode-ray tube display.
BLODI, program that allowed circuit designers to test circuit designs without actually building them.

1965—SWAP, universal assembler program containing many features previously available only in separate programs.
Fast Fourier Transform algorithm for efficiently processing complex signals in real time.
L^6, programming language that allowed programmers to manipulate complexly linked data, write faster-running programs, and use computer storage more efficiently.

1968—GRAPHIC 2, advanced version of GRAPHIC 1 for use by drafting personnel, circuit designers and engineers.

1969—UNIX, a time-shared software system for minicomputers. Used for such diverse purposes as text editing, general computing and switching system trouble reporting.

COMPUTER POWER AND HUMAN REASON

Computer Power and Human Reason: From Judgement to Calculation, by Joseph Weizenbaum, W.H. Freeman & Co., 1976, 300 pp., $9.95.

Computer Power and Human Reason: From Judgement to Calculation is probably the most significant computer book issued in 1976, if not for the last decade. It is basically an account of the impact of scientific technology on man's self-image. It is a distinguished computer scientist's probe of the limits of computer power and of scientific rationality itself. Above all, it is a defense of the sanctity of the human spirit.

Presented here are three reviews of the book. The first one by *Creative Computing* Contributing Editor John Lees examines mostly the human freedom and ethical issues. The second by John McCarthy of Stanford focuses on inconsistencies in the book and defends various people and institutions that were attacked by Weizenbaum. In addition, McCarthy introduces some new issues on "What worries about computers are warranted?". The third review by *Creative Computing* Reviews Editor Peter Kugel focuses on the questions "What should one think and what should one work on?"

We expected to have Weizenbaum's rebuttal to these reviews in this issue, but alas it did not arrive by the typeset deadline. Maybe next issue.

The book itself is available through the *Creative Computing* Library for $9.95 plus 75¢ shipping (USA) or $1.75 (elsewhere). Creative Computing Library, P.O. Box 789-M, Morristown, NJ 07960.

If, after reading the book and reviews, you wish to correspond with Weizenbaum or any of the reviewers, here are their addresses. Please send a carbon of any correspondence to us at *Creative*, too. —DHA

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A Return to Freedom and Dignity

The twentieth century has been a century of the triumph of science and technology. The attempt has been made to bring all things in our universe, if not under the control, at least within the scientific understanding of man. In 1971, with the publication of *Beyond Freedom and Dignity*, B.F. Skinner tried to reduce all of human affairs to the scope of a technology of behavior; a culmination of the viewpoint that technology can and *should* be used to exercise complete control of the world. In the realm of computer science, the Artificial Intelligentsia are claiming that man can be understood totally as an information processing system, an attitude which has lead to an increasingly mechanical view of man and society, with no place remaining for responsible ethics. In his book, Joseph Weizenbaum, Professor of Computer Science at MIT, explores two major questions: whether there is a difference between man and machine, and whether there are tasks for which computers *ought* not to be used, even if it is possible for computers to be used for those tasks.

In the 1960's Professor Weizenbaum composed a computer program, named ELIZA, which could hold a "conversation" in English with a human partner. Supplied with a "script" for playing psychiatrist, ELIZA, known as DOCTOR, became somewhat famous as one of the first programs of its kind. As is too often the case, many people mistook a clever demonstration as evidence that the computer was a "person who could be appropriately and usefully addressed in intimate terms." When some psychiatrists suggested that improved versions of ELIZA might do much of the work of a human therapist, Professor Weizenbaum was awakened to what Michael Polanyi has called "a scientific outlook that appears to have produced a mechanical conception of man," and he was disturbed by the "enormously exaggerated attributions an even well-educated audience is capable of making, even strives to make, to a technology it does not understand." From these feelings and misgivings came the desire for clarification which led to *Computer Power and Human Reason*.

For some purposes, man can be thought of as an information processing system, but intelligent machines will not be human machines.

Concerned with where computers fit into human society and with how the use of computers is changing our view of ourselves, Professor Weizenbaum believes that there *are* differences between man and machine and that this means that there are certain tasks which machines ought not to perform. He points out that "however much intelligence computers may attain, now or in the future, theirs must always be an intelligence *alien* to genuine human problems and concerns." He does not discount the possibility that we may someday succeed in constructing very intelligent machines, nor does he disagree that, for some purposes, man can be thought of as an information processing system, but *intelligent* machines will not be *human* machines; it is not right for machines to perform tasks which are in essence human, and it is demeaning to deal with humans in the same terms in which one deals with machines.

Professor Weizenbaum does not give a rigorous argument for his belief that there are fundamental differences between man and machine, but he is not writing as a metaphysician. It is in any case doubtful that man will be mature enough to answer that question with finality for many thousands of years. We now know almost nothing about such things as human neurophysiology and what is really going on in the brain. The task of translating from one natural language to another, once believed simple, has proved to be astoundingly complex, requiring a machine which can deal with context and meaning as seen by human beings belonging to different cultures. It is obvious that machines with human capabilities, even if possible, are so far off as to be practically impossible.

The real question is *why do we want machines with human capabilities?* Are we trying to bring about the Trafalmadorian situation of asking our machines what we are good for and receiving the reply that we are good for nothing since the machines

If we treat each other like machines, if we act like machines, then we will become no longer human.

can do everything a human can do and more? Professor Weizenbaum believes the desire to manufacture machines which can perform such human functions as therapist or judge to be odious and obscene: "The point is that there are some human functions for which computers *ought* not to be substituted. It has nothing to do with what computers can or cannot be made to do. Respect, understanding, and love are not technical problems."

This is the point he strives to make throughout the book and particularly in his concluding chapter. Not all of our problems have technical solutions. Human problems require human solutions, not because no other solutions are possible, but because we are in danger of losing our humanity if we do not act to retain our humanity. If we treat each other like machines, if we act like machines, then we will become no longer human. We are human not because we are born with hands and faces; we are human through our *actions*, through our ability to make eithical decisions of right and wrong, and because we can perceive higher purposes in our lives than being cogs in a machine.

So many of the world's ills can be traced to seeing the world as a machine and men as machines within a machine. That attitude turns forests into lumber, lakes into sewage, land into property, and people into consumers; it allows otherwise sane men to calmly do research leading to improved methods of killing people, without ever questioning the morality of their actions; it allows data processors to treat people like objects which must be standardized, optimized, and made to conform; it allows schools to 'produce' graduates for the job market who have skills, but lack the necessary understanding of the power and limitations of their tools.

The mechanical conception of man all too often is used as an excuse for taking no action where action is needed. Too many see their lives as simply the inevitable result of a process which they cannot affect. This is a seriously dangerous attitude, and Professor Weizenbaum calls for people to rise above it and assert their freedom, their dignity, and their humanity:

"It is a widely held but a grievously mistaken belief that civil courage finds exercise only in the context of world-shaking events. To the contrary, its most arduous exercise is often in those small contexts in which the challenge is to overcome the fears induced by petty concerns over career, over our relationships to those who appear to have power over us, over whatever may disturb the tranquility of our mundane existence.

"If this book is to be seen as advocating anything, then let it be a call to this simple kind of courage. And, because this book is, after all, about computers, let that call be heard mainly by teachers of computer science."

John Lees
Rolla, MO

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An Unreasonable Book*

This moralistic and incoherent book uses computer science and technology as an illustration to support the view promoted by Lewis Mumford, Theodore Roszak, and Jacques Ellul, that science has led to an immoral view of man and the world. I am frightened by its arguments that certain research should not be done if it is based on or might result in an "obscene" picture of the world and man. Worse yet, the book's notion of "obscenity" is vague enough to admit arbitrary interpretations by activist bureaucrats.

IT'S HARD TO FIGURE OUT WHAT HE REALLY BELIEVES . . .

Weizenbaum's style involves making extreme statements which are later qualified by contradictory statements. Therefore, almost any quotation is out of context, making it difficult to summarize his contentions accurately.

The following passages illustrate the difficulty:

"In 1935, Michael Polanyi", [British chemist and philosopher of science, was told by] *"Nicolai Bukharin, one of the leading theoreticians of the Russian Communist party, . . .* [*that*] *'under socialism the conception of science pursued for its own sake would disappear, for the interests of scientists would spontaneously turn to the problems of the current Five Year Plan.' Polanyi sensed then that 'the scientific outlook appeared to have produced a mechanical conception of man and history in which there was no place for science itself.' And further that 'this conception denied altogether any intrinsic power to thought and thus denied any grounds for claiming freedom of thought.'"* - from page 1. Well, that's clear enough; Weizenbaum favors freedom of thought and science and is worried about threats to them. But on page 265, we have

"Scientists who continue to prattle on about 'knowledge for its own sake' in order to exploit that slogan for their self-serving ends have detached science and knowledge from any contact with the real world". Here Weizenbaum seems to be against pure science, i.e. research motivated solely by curiosity. We also have

"With few exceptions, there have been no results, from over twenty years of artificial intelligence research, that have found their way into industry generally or into the computer industry in particular". - page 229. This again suggests that industrial results are necessary to validate science.

"Science promised man power. But as so often happens when people are seduced by promises of power . . . the price actually paid is servitude and impotence". This is from the book jacket. Presumably the publisher regards it as a good summary of the book's main point.

"I will, in what follows, try to maintain the position that there is nothing wrong with viewing man as an information processor (or indeed as anything else) nor with attempting to understand him from that perspective, providing, however, that we never act as though any single perspective can comprehend the whole man." - page 140. We can certainly live with that, but

"Not only has our unbounded feeding on science caused us to become dependent on it, but, as happens with many other drugs taken in increasing dosages, science has been gradually converted into a slow acting poison". - page 13. These are qualified by

"I argue for the rational use of science and technology, not for its mystification, let alone its abandonment". - page 256.

In reference to the proposal for a moratorium on certain experiments with recombinant DNA because they might be dangerous, we have *"Theirs is certainly a step in the right direction, and their initiative is to be applauded. Still, one may ask, why do they feel they have to give a reason for what they recommend at all? Is not the overriding obligation on men, including men of science, to exempt life itself from the madness of treating everything as an object, a sufficient reason, and one that does not even have to be spoken? Why does it have to be explained? It would appear that even the noblest acts of the most well-meaning people are poisoned by the corrosive climate of values of our time."* Is Weizenbaum against all experimental biology or even all experiments with DNA? I would hesitate to conclude so from this quote; he may say the direct opposite somewhere else.

"Those who know who and what they are do not need to ask what they should do." - page 273. Let me assure the reader that there is nothing in the book that offers any way to interpret this pomposity. The menace of such grandiloquent precepts is that they require a priesthood to apply them to particular cases, and would-be priests quickly crystallize around any potential center of power. A corollary of this is that people can be attacked for what they are rather than for anything specific they have done. The April 1976 issue of *Ms.* has a poignant illustration of this in an article about "trashing".

"An individual is dehumanized whenever he is treated as less than a whole person". - page 266. This is also subject to priestly interpretation as in the encounter group movement.

"The first kind [of computer application] *I would call simply obscene. These are ones whose very contemplation ought to give*

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*This review is appearing simultaneously in the ACM SIGART Newsletter and originally "appeared" in a public file on the ARPA net.

rise to feelings of disgust in every civilized person. The proposal I have mentioned, that an animal's visual system and brain be coupled to computers, is an example. It represents an attack on life itself. One must wonder what must have happened to the proposers' perception of life, hence to their perceptions of themselves as part of the continuum of life, that they can even think of such a thing, let alone advocated it". No argument is offered that might be answered, and no attempt is made to define criteria of acceptability. I think Weizenbaum and the scientists who have praised the book may be surprised at some of the repressive uses to which the book will be put. However, they will be able to point to passages in the book with quite contrary sentiments, so the repression won't be their fault.

BUT HERE'S A TRY AT SUMMARIZING

As these inconsistent passages show, it isn't easy to determine Weizenbaum's position, but the following seem to be the book's main points.

1. Computers cannot be made to reason usefully about human affairs. This is supported by quoting over-optimistic predictions by computer scientists and giving examples of non-verbal human communication. However, Weizenbaum doesn't name any specific task that computers cannot carry out, because he wishes *"to avoid the unnecessary, interminable, and ultimately sterile exercise of making a catalogue of what computers will and will not be able to do, either here and now or ever."* It is also stated that human and machine reasoning are incomparable and that the sensory experience of a human is essential for human reasoning.

2. There are tasks that computers should not be programmed to do. Some are tasks Weizenbaum thinks shouldn't be done at all—mostly for new left reasons. One may quarrel with his politics, and I do, but obviously computers shouldn't do what shouldn't be done. However, Weizenbaum also objects to computer hookups to animal brains and computer conducted psychiatric interviews. As to the former, I couldn't tell whether he is an anti-vivisectionist, but he seems to have additional reasons for calling them "obscene". The objection to computers doing psychiatric interviews also has a component beyond the conviction that they would necessarily do it badly. Thus he says, *"What can the psychiatrist's image of his patient be when he sees himself, as a therapist, not as an engaged human being acting as a healer, but as an information processor following rules, etc.?"* This seems like the renaissance era religious objections to dissecting the human body that came up when science revived. Even the Popes eventually convinced themselves that regarding the body as a machine for scientific or medical purposes was quite compatible with regarding it as the temple of the soul. Recently they have taken the same view of studying mental mechanisms for scientific or psychiatric purposes.

3. Science has led people to a wrong view of the world and of life. The view is characterized as mechanistic, and the example of clockwork is given. (It seems strange for a computer scientist to give this example, because the advance of the computer model over older mechanistic models is that computers can and clockwork can't make decisions.) Apparently analysis of a living system as composed of interacting parts rather than treating it as an unanalyzed whole is bad.

4. Science is not the sole or even main source of reliable general knowledge. However, he doesn't propose any other sources of knowledge or say what the limits of scientific knowledge is except to characterize certain thoughts as "obscene".

5. Certain people and institutions are attacked. These include the Department of "Defense" (sic), *Psychology Today*, the *New York Times* Data Bank, compulsive computer programmers, Kenneth Colby, Marvin Minsky, Roger Schank, Allen Newell, Herbert Simon, J.W. Forrester, Edward Fredkin, B.F. Skinner, Warren McCulloch (until he was old), Laplace and Leibniz.

6. Certain political and social views are taken for granted. The view that U.S. policy in Vietnam was "murderous" is used to support an attack on "logicality" (as opposed to "rationality") and the view of science as a "slow acting poison". The phrase *"It may be that the people's cultivated and finally addictive hunger for private automobiles ..."* (p. 30) makes psychological, sociological, political, and technological presumptions all in one phrase. Similarly, *"Men could instead choose to have truly safe automobiles, decent television, decent housing for everyone, or comfortable, safe, and widely distributed mass transportation."* presumes wide agreement about what these things are, what is technologically feasible, what the effects of changed policies would be, and what activities aimed at changing people's taste are permissible for governments.

THE ELIZA EXAMPLE

Perhaps the most interesting part of the book is the account of his own program ELIZA that parodies Rogerian non-directive psychotherapy and his anecdotal account of how some people ascribe intelligence and personality to it. In my opinion, it is quite natural for people who don't understand the notion of algorithm to imagine that a computer computes analogously to the way a human reasons. This leads to the idea that accurate computation entails correct reasoning and even to the idea that computer malfunctions are analogous to human neuroses and psychoses. Actually, programming a computer to draw interesting conclusions from premises is very difficult and only limited success has been attained. However, the effect of these natural misconceptions shouldn't be exaggerated; people readily understand the truth when it is explained, especially when it applies to a matter that concerns them. In particular, when an executive excuses a mistake by saying that he placed excessive faith in a computer, a certain skepticism is called for.

Colby's (1973) study is interesting in this connection, but the interpretation below is mine. Colby had psychiatrists interview patients over a teletype line and also had them interview his PARRY program that simulates a paranoid. Other psychiatrists were asked to decide from the transcripts whether the interview was with a man or with a program, and they did no better than chance. However, since PARRY is incapable of the simplest causal reasoning, if you ask, "How do you know the people following you are Mafia" and get a reply that they look like Italians, this must be a man not PARRY. Curiously, it is easier to imitate (well enough to fool a psychiatrist) the emotional side of a man than his intellectual side. Probably the subjects expected the machine to have more logical ability, and this expectation contributed to their mistakes. Alas, random selection from the directory of the Association for Computing Machinery did no better.

It seems to me that ELIZA and PARRY show only that people, including psychiatrists, often have to draw conclusions on slight evidence, and are therefore easily fooled. If I am right, two sentences of instruction would allow them to do better.

In his 1966 paper on ELIZA (cited as 1965), Weizenbaum writes,

"One goal for an augmented ELIZA program is thus a system which already has access to a store of information about some aspect of the real world and which, by means of conversational interaction with people, can reveal both what it knows, i.e. behave as an information retrieval system, and where its knowledge ends and needs to be augmented. Hopefully the augmentation of its knowledge will also be a direct consequence of its conversational experience. It is precisely the prospect that such a program will converse with many people and learn something from each of them which leads to the hope that it will prove an interesting and even useful conversational partner." Too bad he didn't successfully pursue this goal; no-one else has. I think success would have required a better understanding of formalization than is exhibited in the book.

WHAT DOES HE SAY ABOUT COMPUTERS?

While Weizenbaum's main conclusions concern science in general and are moralistic in character, some of his remarks about computer science and AI are worthy of comment.

1. He concludes that since a computer cannot have the experience of a man, it cannot understand a man. There are three points to be made in reply. First, humans share each other's experiences and those of machines or animals only to a limited extent. In particular, men and women have different experiences. Nevertheless, it is common in literature for a good writer to show greater understanding of the experience of the opposite sex than a poorer writer of that sex. Second, the notion of experience is poorly understood; if we understood it better, we could reason about whether a machine could have a simulated or vicarious experience normally confined to humans. Third, what we mean by understanding is poorly understood, so we don't yet know how to define whether a machine understands something or not.

2. Like his predecessor critics of artificial intelligence, Taube, Dreyfus and Lighthill, Weizenbaum is impatient, implying that if the problem hasn't been solved in twenty years, it is time to give up. Genetics took about a century to go from Mendel to the genetic code for proteins, and still has a long way to go before we will fully understand the genetics and evolution of intelligence and behavior. Artificial intelligence may be just as difficult. My

What would it mean for a computer to hope for love? The answer depends on being able to formalize (not simulate) the phenomena in question.

current answer to the question of when machines will reach human-level intelligence is that a precise calculation shows that we are between 1.7 and 3.1 Einsteins and .3 Manhattan Projects away from the goal. However, the current research is producing the information on which the Einstein will base himself and is producing useful capabilities all the time.

3. The book confuses computer simulation of a phenomenon with its formalization in logic. A simulation is only one kind of formalization and not often the most useful — even to a computer. In the first place, logical and mathematical formalizations can use partial information about a system insufficient for a simulation. Thus the law of conservation of energy tells us much about possible energy conversion systems before we define even one of them. Even when a simulation program is available, other formalizations are necessary even to make good use of the simulation. This review isn't the place for a full explanation of the relations between these concepts.

Like *Punch's* famous curate's egg, the book is good in parts. Thus it raises the following interesting issues:

1. What would it mean for a computer to hope or be desperate for love? Answers to these questions depend on being able to formalize (not simulate) the phenomena in question. My guess is that adding a notion of hope to an axiomatization of belief and wanting might not be difficult. The study of *propositional attitudes* in philosophical logic points in that direction.

2. Do differences in experience make human and machine intelligence necessarily so different that it is meaningless to ask whether a machine can be more intelligent than a machine? My opinion is that comparison will turn out to be meaningful. After all, most people have no doubt that humans are more intelligent than turkeys. Weizenbaum's examples of the dependence of human intelligence on sensory abilities seem even refutable, because we recognize no fundamental difference in humanness in people who are severely handicapped sensorily, e.g. the deaf, dumb and blind or paraplegics.

IN DEFENSE OF THE UNJUSTLY ATTACKED — SOME OF WHOM ARE INNOCENT

Here are defenses of Weizenbaum's targets. They are not guaranteed to entirely suit the defendees.

Weizenbaum's conjecture that the Defense Department supports speech recognition research in order to be able to snoop on telephone conversations is biased, baseless, false, and seems motivated by political malice. The committee of scientists that proposed the project advanced quite different considerations, and the high officials who made the final decisions are not ogres. Anyway their other responsibilities leave them no time for complicated and devious considerations. I put this one first, because I think the failure of many scientists to defend the Defense Department against attacks they know are unjustified, is unjust in itself, and furthermore has harmed the country.

Weizenbaum doubts that computer speech recognition will have cost-effective applications beyond snooping on phone conversations. He also says, *"There is no question in my mind that there is no pressing human problem that will be more easily solved because such machines exist."* I worry more about whether the programs can be made to work before the sponsor loses patience. Once they work, costs will come down. Winograd pointed out to me that many possible household applications of computers may not be feasible without some computer speech recognition. One needs to think both about how to solve recognized problems and about opportunities to put new technological possibilities to good use. The telephone was not invented by a committee considering already identified problems of communication.

Referring to *Psychology Today* as a cafeteria simply excites the snobbery of those who would like to consider their psychological knowledge to be above the popular level. So far as I know, professional and academic psychologists welcome the opportunity offered by *Psychology Today* to explain their ideas to a wide public. They might even buy a cut-down version of Weizenbaum's book if he asks them nicely. Hmm, they might even buy this review. (No, they didn't.)

There is a whole chapter attacking "compulsive computer programmers" or "hackers." This mythical beast lives in the computer laboratory, is an expert on all the ins and outs of the time-sharing system, elaborates the time-sharing system with arcane features that he never documents, and is always changing the system before he even fixes the bugs in the previous version.

Weizenbaum has invented a *New York Times Data Bank* different from the one operated by the *New York Times* — and possibly better. The real one stores abstracts written by humans and doesn't use the tapes intended for typesetting machines. As a result the user has access only to abstracts and cannot search on features of the stories themselves, i.e. he is at the mercy of what the abstractors thought was important at the time.

Using computer programs as psychotherapists, as Colby proposed, would be moral if it would cure people. Unfortunately, computer science isn't up to it, and maybe the psychiatrists aren't either.

I agree with Minsky in criticizing the reluctance of art theorists to develop formal theories. George Birkhoff's formal theory was probably wrong, but he shouldn't have been criticized for trying. The problem seems very difficult to me, and I have made no significant progress in responding a challenge from Arthur Koestler to tell how a computer program might make or even recognize jokes. Perhaps some reader of this review might have more success.

There is a whole chapter attacking "compulsive computer programmers" or "hackers." This mythical beast lives in the computer laboratory, is an expert on all the ins and outs of the time-sharing system, elaborates the time-sharing system with arcane features that he never documents, and is always changing the system before he even fixes the bugs in the previous version. All these vices exist, but I can't think of any individual who combines them, and people generally outgrow them. As a laboratory director, I have to protect the interests of people who program only part time against tendencies to over-complicate the facilities. People who spend all their time programming and who exchange information by word of mouth sometimes have to be pressed to make proper writeups. The other side of the issue is that we professors of computer science sometimes lose our ability to write actual computer programs through lack of practice and envy younger people who can spend full time in the laboratory. The phenomenon is well known in other sciences and in other human activities.

Weizenbaum attacks the Yale computer linguist, Roger Schank, as follows — the inner quotes are from Schank *"What is contributed when it is asserted that 'there exists a conceptual base that is interlingual, onto which linguistic structures in a given language map during the understanding process and out of which such structures are created during generation (of linguistic utterances)? Nothing at all. For the term 'conceptual base' could perfectly well be replaced by the word 'something.' And who could argue with that so-transformed statement?"* Weizenbaum goes on to say that the real scientific problem "remains as untouched as ever." On the next page he says that unless the "Schank-like scheme" understood the sentence *"Will you come to dinner with me this evening?"* to mean *"a shy young man's desperate longing for love,* then the sense in which the system "understands" is "about as weak as the sense in which ELIZA "understood." This good example raises interesting issues and seems to call for some distinctions. Full understanding of the sentence indeed results in knowing about the young man's desire for love, but it would seem that there is a useful lesser level of understanding in which the machine would know only that he would like her to come to dinner.

Contrast Weizenbaum's demanding, more-human-than-thou attitude to Schank and Winograd with his respectful and even obsequious attitude to Chomsky. We have *"The linguist's first task is therefore to write grammars, that is, sets of rules, of particular languages, grammars capable of characterizing all and only the grammatically admissible sentences of those languages, and then to postulate principles from which crucial features of all such grammars can be deduced. That set of principles would then constitute a universal grammar. Chomsky's hypothesis is, to put it another way, that the rules of such a universal grammar would constitute a kind of projective description of important aspects of the human mind."* There is nothing here demanding that the universal grammar take into account the young man's desire for love. As far as I can see, Chomsky is just as much a rationalist as we artificial intelligentsia.

Chomsky's goal of a universal grammar and Schank's goal of a conceptual base are similar, except that Schank's ideas are further developed, and the performance of his students' programs can be compared with reality. I think they will require drastic revision and may not be on the right track at all, but then I am pursuing a rather different line of research concerning how to represent the basic facts that an intelligent being must know about the world. My idea is to start from epistemology rather than from language, regarding their linguistic representation as secondary. This approach has proved difficult, has attracted few practitioners, and has led to few computer programs, but I still think it's right.

Weizenbaum approves of the Chomsky school's haughty attitude towards Schank, Winograd and other AI based language researchers. On page 184, he states, *"many linguists, for example, Noam Chomsky, believe that enough thinking about language remains to be done to occupy them usefully for yet a little while, and that any effort to convert the present theories into computer models would, if attempted by the people best qualified, be a diversion from the main task. And they rightly see no point to spending any of their energies studying the work of the hackers."*

This brings the chapter on "compulsive computer programmers" alias "hackers" into a sharper focus. Chomsky's latest book *Reflections on Language* makes no reference to the work of Winograd, Schank, Charniak, Wilks, Bobrow or William Woods to name only a few of those who have developed large computer systems that work with natural language and who write papers on the semantics of natural language. The actual young computer programmers who call themselves hackers and who come closest to meeting Weizenbaum's description don't write papers on natural language. So it seems that the hackers whose work need not be studied are Winograd, Schank, et. al. who are professors and senior scientists. The Chomsky school may be embrassed by the fact that it has only recently arrived at the conclusion that the semantics of natural language is more fundamental than its syntax, while AI based researchers have been pursuing this line for fifteen years.

The outside observer should be aware that to some extent this is a pillow fight within M.I.T. Chomsky and Halle are not to be dislodged from M.I.T. and neither is Minsky — whose students have pioneered the AI approach to natural language. Schank is quite secure at Yale. Weizenbaum also has tenure. However, some assistant professorships in linguistics may be at stake, especially at M.I.T.

Allen Newell and Herbert Simon are criticized for being overoptimistic and are considered morally defective for attempting to describe humans as difference-reducing machines. Simon's view that the human is a simple system in a complex environment is singled out for attack. In my opinion, they were overoptimistic, because their GPS model on which they put their bets wasn't good enough. Maybe Newell's current *production system models* will work out better. As to whether human mental structure will eventually turn out to be simple, I vacillate but incline to the view that it will turn out to be one of the most complex biological phenomena.

I regard Forrester's models as incapable of taking into account qualitative changes, and the world models they have built as defective even in their own terms, because they leave out saturation-of-demand effects that cannot be discovered by curve-fitting as long as a system is rate-of-expansion limited. Moreover, I don't accept his claim that his models are better suited than the unaided mind in "interpreting how social systems behave," but Weizenbaum's sarcasm on page 246 is unconvincing. He quotes Forrester, "[desirable modes of behavior of the social system] *seem to be possible only if we have a good understanding of the system dynamics and are willing to endure the self-discipline and pressures that must accompany the desirable mode."* Weizenbaum comments, *"There is undoubtedly some interpretation of the words 'system' and 'dynamics' which would lend a benign meaning to this observation."* Sorry, but it looks ok to me provided one is suitably critical of Forrester's proposed social goals and the possibility of making the necessary assumptions and putting them into his models.

Skinner's behaviorism that refuses to assign reality to people's internal state seems wrong to me, but we can't call him immoral for trying to convince us of what he thinks is true.

Weizenbaum quotes Edward Fredkin, former director of Project MAC, and the late Warren McCulloch of M.I.T. without giving their names. pp. 241 and 240. Perhaps he thinks a few puzzles will make the book more interesting, and this is so. Fredkin's plea for research in automatic programming seems to overestimate the extent to which our society currently relies on computers for decisions. It also overestimates the ability of the faculty of a particular university to control the uses to which technology will be put, and it underestimates the difficulty of making knowledge based systems of practical use. Weizenbaum is correct in pointing out that Fredkin doesn't mention the existence of genuine conflicts in society, but only the new left sloganeering elsewhere in the book gives a hint as to what he thinks they are and how he proposes to resolve them.

As for the quotation from (McCulloch 1956), Minsky tells me "this is a brave attempt to find a dignified sense of freedom within the psychological determinism morass." Probably this can be done better now, but Weizenbaum wrongly implies that McCulloch's 1956 effort is to his moral discredit.

Finally, Weizenbaum attributes to me two statements — both from oral presentations — which I cannot verify. One of them is *"The only reason we have not yet succeeded in simulating every aspect of the real world is that we have been lacking a sufficiently powerful logical calculus. I am working on that problem."* This statement doesn't express my present opinion or my opinion in 1973 when I am alleged to have expressed it in a debate, and noone has been able to find it in the video-tape of the debate.

We can't simulate "every aspect of the real world," because the initial state information is never available, the laws of motion are imperfectly known, and the calculations for a simulation are too extensive. Moreover, simulation wouldn't necessarily answer our questions. Instead, we must find out how to represent in the memory of a computer the information about the real world that is actually available to a machine or organism with given sensory capability, and also how to represent a means of drawing those useful conclusions about the effects of courses of action that can be correctly inferred from the attainable information. Having a *sufficiently powerful logical calculus* is an important part of this problem — but one of the easier parts.

The second quotation from me is the rhetorical question, *"What do judges know that we cannot tell a computer."* I'll stand on that if we make it "eventually tell" and especially if we require that it be something that one human can reliably teach another.

A SUMMARY OF POLEMICAL SINS

The speculative sections of the book contain numerous dubious little theories, such as this one about the dehumanizing effect of the invention of the clock: *"The clock had created literally a new reality; and that is what I meant when I said earlier that the trick man turned that prepared the scent for the rise of modern science was nothing less than the transformation of nature and of his perception of reality. It is important to realize that this newly created reality was and remains an improverished version of the older one, for it rests on a rejection of those direct experiences that formed the basis for, and indeed constituted the old reality. The feeling of hunger was rejected as a stimulus for eating; instead one ate when an abstract model had achieved a certain state, i.e. when the hand of a clock pointed to certain marks on the clock's face (the anthropomorphism here is highly significant too), and similarly for signals for sleep and rising, and so on."*

However, when home terminals become available, social changes of the magnitude of those produced by the telephone and automobile will occur.

This idealization of primitive life is simply thoughtless. Like modern man, primitive man ate when the food was ready, and primitive man probably had to start preparing it even further in advance. Like modern man, primitive man lived in families whose members are no more likely to become hungry all at once than are the members of a present family.

I get the feeling that in toppling this microtheory I am not playing the game; the theory is intended only to provide an atmosphere, and like the reader of a novel, I am supposed to suspend disbelief. But the contention that science has driven us from a psychological Garden of Eden depends heavily on such word pictures.

By the way, I recall from my last sabbatical at M.I.T. that the *feeling of hunger* is more often the *direct social stimulus for eating* for the "hackers" deplored in Chapter 4 than it could have been for primitive man. Often on a crisp New England night, even as the clock strikes three, I hear them call to one another, messages flash on the screens, a flock of hackers magically gathers, and the whole picturesque assembly rushes chattering off to Chinatown.

I find the book substandard as a piece of polemical writing in the following respects:

1. The author has failed to work out his own positions on the issues he discusses. Making an extreme statement in one place and a contradictory statement in another is no substitute for trying to take all the factors into account and reach a considered position. Unsuspicious readers can come away with a great variety of views, and the book can be used to support contradictory positions.

2. The computer linguists — Winograd, Schank, et. al. — are denigrated as hackers and compulsive computer programmers by innuendo.

3. One would like to know more precisely what biological and psychological experiments and computer applications he finds acceptable. Reviewers have already drawn a variety of conclusions on this point.

4. The terms "authentic," "obscene," and "dehumanization" are used as clubs. This is what mathematicians call "proof by intimidation."

5. The book encourages a snobbery that has no need to argue for its point of view but merely utters code words, on hearing which the audience is supposed to applaud or hiss as the case may be. The *New Scientist* reviewer and Daniel McCracken in *Datamation* certainly salivate in most of the intended places.

6. Finally, when moralizing is both vehement and vague, it invites authoritarian abuse either by existing authority or by new political movements. Imagine, if you can, that this book were the bible of some bureaucracy, e.g. an Office of Technology Assessment, that acquired power over the computing or scientific activities of a university, state, or country. Suppose Weizenbaum's slogans were combined with *the bureaucratic ethic* that holds that any problem can be solved by a law forbidding something and a bureaucracy of eager young lawyers to enforce it. Postulate further a vague *Humane Research Act* and a "public interest" organization with more eager young lawyers suing to get judges to legislate new interpretations of the Act. One can see a laboratory needing more lawyers than scientists and a Humane Research Administrator capable of forbidding or requiring almost anything.

I see no evidence that Weizenbaum forsees his work being used in this way; he doesn't use the phrase *laissez innover* which is the would-be science bureaucrat's analogue of the economist's *laissez faire,* and he never uses the indefinite phrase "it should be decided" which is a common expression of the bureaucratic ethic. However, he has certainly given his fellow computer scientists at least some reason to worry about potential tyranny.

Let me conclude this section with a quotation from Andrew D. White, the first president of Cornell University, that seems applicable to the present situation — not only in computer science, but also in biology. — *"In all modern history, interference with science in the supposed interest of religion, no matter how conscientious such interference may have been, has resulted in the direst evils both to religion and to science, and invariably; and, on the other hand, all untrammelled scientific investigation, no matter how dangerous to religion some of its stages may have seemed for the time to be, has invariably resulted in the highest good both of religion and of science."* Substitute *morality* for *religion* and the parallel is clear. Frankly, the feebleness of the reaction to attacks on scientific freedom worries me more than the strength of the attacks.

WHAT WORRIES ABOUT COMPUTERS ARE WARRANTED?

Grumbling about Weizenbaum's mistakes and moralizing is not enough. Genuine worries prompted the book, and many people share them. Here are the genuine concerns that I can identify and the opinions of one computer scientist about their resolution: What is the danger that the computer will lead to a false model of man? What is the danger that computers will be misused? Can human-level artificial intelligence be achieved? What, if any, motivational characteristics will it have? Would the achievement of artificial intelligence be good or bad for humanity?

1. Does the computer model lead to a false model of man? Historically, the mechanistic model of the life and the world followed animistic models in accordance with which, priests and medicine men tried to correct malfunctions of the environment and man by inducing spirits to behave better. Replacing them by mechanistic models replaced shamanism by medicine. Roszak explicity would like to bring these models back, because he finds them more "human," but he ignores the sad fact that they don't work, because the world isn't constructed that way. The pre-computer mechanistic models of the mind were, in my opinion, unsuccessful, but I think the psychologists pursuing computational models of mental processes may eventually develop a really beneficial psychiatry.

Philosophical and moral thinking hasn't yet found a model of man that relates human beliefs and purposes to the physical world in a plausible way. Some of the unsuccessful attempts have been more mechanistic than others. Both mechanistic and non-mechanistic models have led to great harm when made the basis of political ideology, because they have allowed tortuous reasoning to justify actions that simple human intuition regards as immoral. In my opinion, the relation between beliefs, purposes and wants to the physical world is a complicated but ultimately solvable problem. Computer models can help solve it, and can provide criteria that will enable us to reject false solutions. The latter is more important for now, and computer models are already hastening the decay of dialectical materialism in the Soviet Union.

2. What is the danger that computers will be misused? Up to now, computers have been just another labor-saving technology. I don't agree with Weizenbaum's acceptance of the claim that our society would have been inundated by paper work without computers. Without computers, people would work a little harder and get a little less for their work. However, when home terminals become available, social changes of the magnitude of those produced by the telephone and automobile will occur. I have discussed them elsewhere, and I think they will be good — as were the changes produced by the automobile and the telephone. Tyranny comes from control of the police coupled with a tyrannical ideology; data banks will be a minor convenience. No dictatorship yet has been overthrown for lack of a data bank.

One's estimate of whether technology will work out well in the future is correlated with one's view of how it worked out in the past. I think it has worked out well — e.g. cars were not a mistake — and am optimistic about the future. I feel that much current ideology is a combination of older anti-scientific and anti-technological views with new developments in the political technology of instigating and manipulating fears and guilt feelings.

3. What motivations will artificial intelligence have? It will have what motivations we choose to give it. Those who finally create it should start by motivating it only to answer questions and should have the sense to ask for full pictures of the consequences of alternate actions rather than simply how to achieve a fixed goal, ignoring possible side-effects. Giving it human motivational structure with its shifting goals sensitive to

The achievement of above-human-level artificial intelligence will open to humanity an incredible variety of options.

physical state would require a deliberate effort beyond that required to make it behave intelligently.

4. Will artificial intelligence be good or bad? Here we are talking about machines with the same range of intellectual abilities as are possessed by humans. However, the science fiction vision of robots with almost precisely the ability of a human is quite unlikely, because the next generation of computers or even hooking computers together would produce an intelligence that might be qualitatively like that of a human, but thousands of times faster. What would it be like to be able to put a hundred years thought into every decision? I think it is impossible to say whether qualitatively better answer would be obtained; we will have to try it and see.

The achievement of above-human-level artificial intelligence will open to humanity an incredible variety of options. We cannot now fully envisage what these options will be, but it seems apparent that one of the first uses of high-level artificial intelligence will be to determine the consequences of alternate policies governing its use. I think the most likely variant is that man will use artificial intelligence to transform himself, but once its properties and the consequences of its use are known, we may decide not to use it. Science would then be a sport like mountain climbing; the point would be to discover the facts about the world using some stylized limited means. I wouldn't like that, but once man is confronted by the actuality of full AI, they may find our opinion as relevant to them as we would find the opinion of *Pithecanthropus* about whether subsequent evolution took the right course.

5. What shouldn't computers be programmed to do. Obviously one shouldn't program computers to do things that shouldn't be done. Moreover, we shouldn't use programs to mislead ourselves or other people. Apart from that, I find none of Weizenbaum's examples convincing. However, I doubt the advisability of making robots with human-like motivational and emotional structures that might have rights and duties independently of humans. Moreover, I think it might be dangerous to make a machine that evolved intelligence by responding to a program of rewards and punishments unless its trainers understand the intellectual and motivational structure being evolved.

All these questions merit and have received more extensive discussion, but I think the only rational policy now is to expect the people confronted by the problem to understand their best interests better than we now can. Even if full AI were to arrive next year, this would be right. Correct decisions will require an intense effort that cannot be mobilized to consider an eventuality that is still remote. Imagine asking the presidential candidates to debate on TV what each of them would do about each of the forms that full AI might take.

Reference:

McCulloch, W.S. (1956) Toward some circuitry of ethical robots or an observational science of the genesis of social evaluation in the mind-like behavior of artifacts. *Acta Biotheoretica,* **XI,** *parts 3/4, 147-156*

John McCarthy
Stanford, California

He worries that the power of the computer reinforces the widespread view that science is all powerful and that all unscientific ways of knowing are, therefore, suspect, fuzzy, vague, and not worthy of our trust.

The Computer's Role vs Man's Role

This book is about computers and their impact on human beings, but don't let that put you off. This is not another one of those dreary, guided tours through computerland or one of those windy sermons on the social significance of the (Gasp!) computer. This is an important book about an important subject. Why, Weizenbaum asks in this book, are we so ready to take the computer so seriously as a complete model for the human mind? And what, if any, are the dangers in doing so? Whether or not one agrees with his answers, they are important answers, well presented.

Weizenbaum tells us that he wrote this book as a result of the reactions he observed to the work for which he probably is best known, namely a computer program called ELIZA and her possibly even better known "son" the DOCTOR. Both of these programs (the latter being the former provided with a script that many find amusing) are based on some rather clever ideas. One of the most important of these is one that we have probably all used—the idea that you can keep your side of a conversation going without listening to the other by either repeating some of the other person's words or by occasionally muttering appropriate trivialities. The DOCTOR program uses this trick to fake what we might call a Rogerian psychiatrist who then encourages responses from patients by using something akin to (but very different from) this conversationalist trick. What surprised Weizenbaum, and led him to write this book, was that people were so eager to take this rather trivial program seriously. Some psychiatrists (e.g. Colby) took it to be a model, not only of the psychiatrist, but also of his patient. (In this connection, you might be interested in the rather amusing response of Weizenbaum's to Colby's simulation or paranoia in a letter in a recent issue of "The Communications of the ACM.") Some people interacting with the program rapidly began to take it seriously and the program even passed a version of Turing's test when a majority of the subjects in an experiment by Quarton and others said that, when conversing with Weizenbaum's program, they thought that they had been dealing with a real person. And other people began to think (as many had, years earlier, after IBM demonstrated "machine translation" at the 1939 New York World's Fair) that the problem of getting machines to handle natural languages had, to all intents and purposes, been solved.

These responses led Weizenbaum to ask why people were so ready to accept this very simple model of their own (and their friends') minds as complete. This book is Weizenbaum's attempt to answer this question.

Weizenbaum recognizes that people's tendency to think of themselves as machines of one sort or another is nothing very new nor, necessarily, anything very bad. We understand machines that we build better than the minds that we have and the similarities between our minds and machines can help us to better understand the former. What worries Weizenbaum is not that we use the computer as a model for ourselves but that we may be taking it too seriously in this role.

The introduction of the computing machine, with its marvelous ability to manipulate symbols rapidly and accurately has simply accelerated man's tendency to take a "rationalistic view of his society and a mechanistic view of himself." Weizenbaum suggests that the question of "whether or not human thought is entirely computable" is merely a sharpening up of a question that has attracted attention for millenia—namely whether or not every aspect of human thought is reducible to some sort of precise formalism. Weizenbaum then addresses two basic questions: "Can human thought be reduced to calculation (or computation)?" and "Even if it can be, ought it to be?" He worries that the power of the computer reinforces the widespread view that science is all powerful and that all unscientific ways of knowing are, therefore, suspect, fuzzy, vague, and not worthy of our trust.

Weizenbaum begins by considering how people tend to think of their tools as a metaphor for their world. The view that man is some kind of machine predates the invention of the computer. But the impact of the computer as methaphor for the mind has

Weizenbaum points out that, contrary to what many have claimed, to be able to program something for a computer is not the same thing as to be able to understand it.

been much greater than that of other machines, and Weizenbaum goes on to explain why. The computer is, in a sense that he describes in two very well written chapters, a universal symbol processing machine. Although Weizenbaum tells us we can read this book without reading these two chapters on "Where the Power of the Computer Comes From" and "How Computers Work," I found them utterly delightful.

These two chapters demonstrate that Weizenbaum's argument comes from somebody who understands the computer. Weizenbaum explains Turing's Universal Machine Theorem in terms that should be accessible to many readers who shy away from anything mathematical, although some may find the explanation a bit wordy. The Turing machine itself is exemplified in terms of stones and the perfect real-life counterpart of the Turing machine's infinite tape divided into squares—a roll of toilet paper.

He goes on to explain logical design and computer languages in a style that should appeal to many people with a shaky understanding of these areas and should be enjoyable to those with solid backgrounds who like to see things they know said well. Some of the remarks he makes are marvelously apt. Thus in explaining the power of languages, he refers to Maslow's comment that, "to the man who has only a hammer, the whole world looks like a nail" to suggest how one's programming language can shape one's view of the world. Weizenbaum concedes that the computer is impressive and it is a suitable model for some thinking but it is not a total model.

Weizenbaum points out that, contrary to what many have claimed, to be able to program something for a computer is not the same thing as to be able to understand it. It helps us to understand something better when we write a program to do it, but it also helps us when we try to describe it in English. Programming something is one way of understanding it, and a good way. What Weizenbaum objects to is thinking that it is the only way.

The computer program, running under the control of a stored program, is an abstraction from the real world (with all its messy details) that many find more appealing than the real thing. It is so comfortable and neat that it can give rise to what Weizenbaum calls the "compulsive programmer" who sits, bleary eyed, in front of his console, totally absorbed by it and the technical problems that it presents to him or her. "The compulsive programmer," writes Weizenbaum, "is merely the proverbial mad scientist who has been given a theatre, the computer, in which he can, and does, play out his fantasies."

There is, according to Weizenbaum, a continuum, ranging from the compulsive programmer at one hand, who seeks to fit the world and its people into his (or her) rather narrow perceptions of what is real, to the fuzzy minded humanist at the other extreme who seeks to understand the human being from all possible perspectives and finds no framework adequate to that purpose. I personally find both extremes somewhat distressing, but Weizenbaum focusses his guns on the compulsive programmer.

Science proceeds by simplifying reality, but Weizenbaum worries that we can overdo such simplification. He compares the computer scientist, who is trying to account for all human thought in terms of the computer, to the drunk who is looking for his keys under the street light, not because that is where he dropped them, but because the light is better there. Scientists do, indeed, tend to look where the light is better. That may be a mistake if they also assume that they are looking in the only possible place, but it is surely not a mistake per se. It is a mistake to think that "man is merely an information processing machine." This limiting view is like a magical system in that it is detached from some (but not necessarily all) human experience.

It is seductive precisely because it gives the person who holds it the illusion of having power that he does not really have. It is bad because it tries to capture all the world in a framework that is too weak to hold it.

There are some things we know only by virtue of having bodies, being children, and being treated as human beings by other human beings.

Weizenbaum argues that there is "nothing wrong with viewing man as an information processor (or indeed as anything else), nor with attempting to understand him from that perspective, providing, however, that we never act as though any single perspective can comprehend the whole man. Our theories are dangerous if we think of them as being like encyclopedias in which we can look up what we want to know rather than as maps or guides that help us to understand but are not total guides to the territory they comprehend. The computer is a powerful instrument in helping us understand our world which is precisely why it is so important to remember that it is not the only instrument we have."

Weizenbaum considers various fields that use the computer metaphor to understand man. He devotes chapters to "Computer Models in Psychology," "The Computer and Natural Language" and to "Artificial Intelligence." The first of these focuses primarily on the ideas of Simon and Colby, the second on ELIZA and the work of Schank. Like other writers on this general subject, Weizenbaum quotes extensively from the rather optimistic writings of Simon whose rather rambunctious claims, having been given with explicit time limits, have proven to be overly optimistic and now provide fine fodder for critics. Weizenbaum is arguing that there is more in heaven and earth than is dreamt of in our computational philosophies and in reminding us of this, he is surely right.

He also points out that there are things that computers cannot ever know about human experience. There are some things we know only by virtue of having bodies, being children, and being treated as human beings by other human beings. And there are things one knows that one may not be able to communicate at all and that one can only understand by having certain experiences as a human being.

These objections, Weizenbaum writes, touch not only on certain technical limitations of computers, but on what it means to be a human being and what it means to be a computer. He examines the arguments of those who find that all human experience must be expressible by computer programs and finds them wanting. His analysis is perceptive (he understands the workers in this field) and probably correct. Interestingly enough, he recognizes that perhaps the best way to communicate even this idea may be in terms of a mechanistic metaphor. Thus when he talks of the contributions of the unconscious he points to the right hemisphere of the human brain (in those of us who are right-handed) where those contributions appear to "come from." It is a bit odd to see him using mechanistic metaphors against the mechanists.

He concedes that computers can make judicial decisions (and) psychiatric judgements but argues that they ought not to make them because they lack the proper background for this role. Even if computers gave the same results as a person in some (or even most) cases, we have no guarantee that they will do so in all. "What emerges as the most elementary insight," he writes, "is that, since we do not have any way of making computers wise, we ought not now to give computers tasks that demand wisdom."

Weizenbaum points to the dangers of what he calls "incomprehensible programs" whose operations are not fully understood. Such programs arise because single programmers do not correctly anticipate the behavior of their programs and because programmers do not program singly.

Incomprehensible programs, and most large programs are incomprehensible in Weizenbaum's sense, cannot be relied on to do what we may think they do and their controlled use can, therefore, be dangerous. This is particularly true in those cases where the decisions made by the program have to be acted on before we have the chance to validate their soundness.

There are, then, at least two reasons not to rely wholly on programs to make human decisions. One is that we know things that programs cannot know and the second is that there are some things that, in a sense, only the program can know and we cannot.

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Weizenbaum is unsparing in pointing out that the triumphs of artificial intelligence, to date, are largely "triumphs of technique" and that even his own programs, such as ELIZA, fall in this category. He notes how few results of artificial intelligence research have found their way into industry. Those few have (like DENDRAL and MACSYMA) come from areas in which a precisely and well understood theory had already been developed. But most programs in AI are not theory-based in the same way. This is why they lead to programs whose behavior it is not necessarily possible to understand.

Our tendency to place too much faith in computer programs is not limited to the artificial intelligentsia. It is found frequently among the military and among those in government. There is a strong desire in bureaucracies of all kinds to harness the inexorable information crunching power of the computer to the bureaucracy's aims and to rely on computers because of their "objectivity." Such a reliance, Weizenbaum finds "mindless" in at least two senses of this word.

Weizenbaum observes that it is a curious fact that the use of a word like "ethics" in conversation about science makes us feel uncomfortable. There are, he suggests, at least two reasons for this, neither of which is totally misplaced. One reason is that we fear that what is about to be said may apply to us and the second is that the conversation will be philosophical in the worst sense, which is to say that it will be vague and tedious. Weizenbaum's critique does apply to most of us in computer science and, therefore, reading him may make you feel uncomfortable. But what Weizenbaum says is, by and large at least, not vague or tedious. It is written in a language, and from a point of view, that a computer scientist can understand.

If I have an important objection to what Weizenbaum is doing in this book (which is not to say that I don't also have some unimportant objections) it is that he is not always doing what he claims to be doing. He argues that his aim is not to convert others to his views but to get people to think about what they themselves feel. But toward the end of his book, Weizenbaum gives in to a natural inclination to try to tell us what to think. He prefaces these suggestions with strong warnings against reading them in this way and says that he is only expressing his own views. But these warnings remind me of a bit of the warnings on cigarette advertisements. They are there, but the rest of the message tells you to ignore them. Thus Weizenbaum says that he thinks that work on speech understanding programs is dangerous and that one should not work on such programs. His arguments seem to me to be pretty weak. He also tells us not to couple animal brains with computers because that would be obscene. I may be coarse, and insensitive, but the obscenity eludes me.

Weizenbaum qualifies his injunctions against such research by saying that such judgements "have no force except on myself." He is right, but why does he give us arguments to convince us to agree with them? "I have learned," he writes, "that people are constantly asking one another what they must do, whereas the only really important question is what they must be." But then he tells us what we must do. I wish he hadn't.

But such injunctions are a minor part of the book and they are easily skimmed. On the whole, Weizenbaum's analysis is very perceptive and very well done. The first three chapters of this book could, I think, be profitably read by students who want to "understand computers." People interested in the impact of the computer on society could profit from reading Weizenbaum's analysis of why the computer is potentially so dangerous, why we are so prone to think of ourselves as being nothing more than flesh and blood computers and why, as Thoreau put it more than a hundred years ago, "men have become the tools of their tools."

But in fact, this book is really primarily addressed to computer scientists and only computer scientists can, I think, really understand it. Weizenbaum admits this. He writes: "If this book is to be seen as advocating anything, then let it be a call to a simple kind of courage. And because this book is, after all, about computers, let that call be heard mainly by teachers of computer science. I want them to have heard me affirm that the computer is a powerful new metaphor for helping us to understand many aspects of the world, but that it enslaves the mind that has no other metaphors and few other resources to call on. The world is many things and no single framework is large enough to contain them all, neither that of man's science nor that of his poetry, neither that of calculating reason nor that of pure intuition."

If you are not familiar with computers, there will be a lot in this book that you may not understand. Be that as it may, if you have at least written a program or two, I think you will find a lot in this book worth thinking, and talking, about. In any case, it is the first book on this subject that I have recommended to my friends. Read it.

Peter Kugel
Boston College, MA

CREATIVE COMPUTING
Reviews

Computers and Creativity by Carole Spearin McCauley. 160 pp. $7.50. Praeger Publishers, Inc., 111 Fourth Ave., New York, N.Y. 10003. 1974.

Computers and Creativity asks whether the computer does or does not have artistic ability. It talks about what can be done with a computer other than calculating or processing data in "uncreative ways." The author spends some time trying to explain creativity and also the ways in which some computers learn.

The style of this book did not particularly appeal to me and some details seemed rather tedious. The content, however, was excellent: the kinds of computer applications that this book describes deserve recognition as a growing field in computer science.

Computers and Creativity does not really give enough details about the programs it describes to tell the average programmer how to go about doing likewise. But it would be useful for the person who wants a general introduction to the use of computers as an artistic tool. It deals, in a cursory way, with such questions as "What is creativity?", "What is a computer?", "How does one talk to computers?", "Can a computer sing?", "Can a computer create a picture, a movie, or an advertisement?", "Can a computer write?", and the required chapter in books like this: "Gasp! What will the computer do next?". The book contains a useful, if partial, 8-page list of references.

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Chestnut Hill, MA

International Journal of the Contemporary Artist

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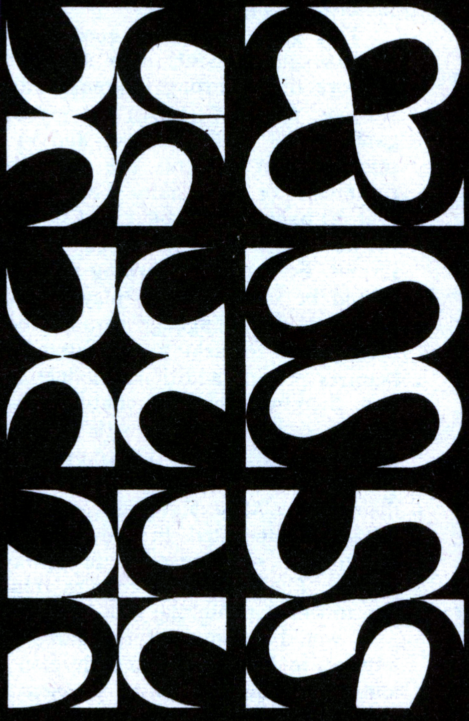


Some illustrations from an article by Michael Thompson
'Computer Art: A visual model for the modular pictures of Manuel Barbadillo'

TTL Cookbook by Donald E. Lancaster. $10.75 Howard W. Sams, Indianapolis, Indiana, 46268. 1974.

People who use computers often get sufficiently involved that a knowledge of hardware becomes useful, whether to understand better how the computer "does it" internally, to maintain a computer system, or to add that special gadget as an input or output device. One needs several sorts of information resources, ranging from catalogs of logic devices (integrated circuits), hardware catalogs, explanations of hardware functions, etc. One can compile an impressive array of logic sheets and catalogs and still not have any guide to putting it all together.

The *TTL Cookbook* does a good job of combining a range of factual information about the logic devices, the folklore and accepted good practice of their use, and a range of techniques and suggestions for projects. It is based on the premise that the TTL logic line has reached its maturity; a wide range of inexpensive functional parts is available and can be usefully combined and applied by persons without much training in electronics. The point is made forcefully that the building-block approach has removed the requirement for many of the standard logic design techniques that were essential a few years ago.

The cookbook analogy implies that the reader can sample a recipe for a particular function (gating, timing, storage, counting, display) or find more general information on the proper preparation of logic systems using TTL devices. This background comes in the first chapter and assumes some acquaintance with the tools of electronic servicing and design such as oscilloscopes, power supplies, decoupling, resonance, inductance, etc. Although necessary before one undertakes a serious design, the detail can be skimmed by the novice if he promises to return later. The second chapter is a catalog of 77 frequently used members of the TTL family, with part numbers, functional names, pin designation diagrams, functional descriptions, logic delays and current requirements. The descriptions also contain cautionary notes about features that might cause problems for the naive user, which will help avoid some of the common problems that sometimes haunt new designs.

A discussion of logic as applied to the TTL line follows in Chapter 3. Then come chapters devoted to gates and timer circuits, flip-flops, counters, shift registers and rate multipliers. Each section discusses several applications ranging from the realization of logic functions to the design of fun projects. Recurring examples include displays using light emitting diodes, timers and music generators. Most examples are relatively complete, although toward the end of the book several are presented in a relatively bare sketch of the technique. The discussion of the television time display and the TV typewriter are left at the high level block diagram stage. These and many other sketches of systems use of the applications detailed in previous chapters are found in the last chapter, entitled "Getting It All Together," designed to challenge the reader to do some design thinking himself. A list of simpler project suggestions, still requiring synthesis, is given at the end and might serve as stimuli for science-fair type activities.

The TTL parts described are readily available, for the most part, and are often available on the surplus market at tremendous reductions in cost. There are a few exceptions which may be aggravated by the particular distributers one uses. The use of a timing device designated as the 555 was new to me; searching for it was aggravated by the fact that manufacturers are mentioned inconsistently. In this case, try Signetics or Intersil NE555 or SE555, about $1.75. Some other types given are not necessarily manufactured by all of the major semiconductor houses, and certainly the cost of some of the devices used will exceed the implied low price unless one has ready access to the surplus market. Some indication of relative pricing would be helpful in the description of parts; the "as low as 30¢ per package" can rise to $10 for some of the circuits. Returning to the analogy implied by the title, a knowledge of basic prices, substitutions and willingness to shop around for good buys, may be as necessary in the logic lab as it is in the kitchen these days.

Robert S. McLean
Toronto, Ontario

Queries 'N Theories (Game), by Layman E. Allen, Peter Kugel and Joan Ross, $9.75. Wff 'N Proof, 1490 South Blvd., Ann Arbor, MI 48104.

QUERIES 'N THEORIES is a game (or series of games) which can be used for several purposes. It incorporates ideas from modern theories of linguistics. The play simulates some important features of the scientific process. The authors state that it is "designed to develop a basic and uniquely human skill: asking good questions." The instruction manual discusses briefly the relationship of the game to both linguistics and the scientific method.

The game is designed for three or more players; there is a variation for two players described in the manual.

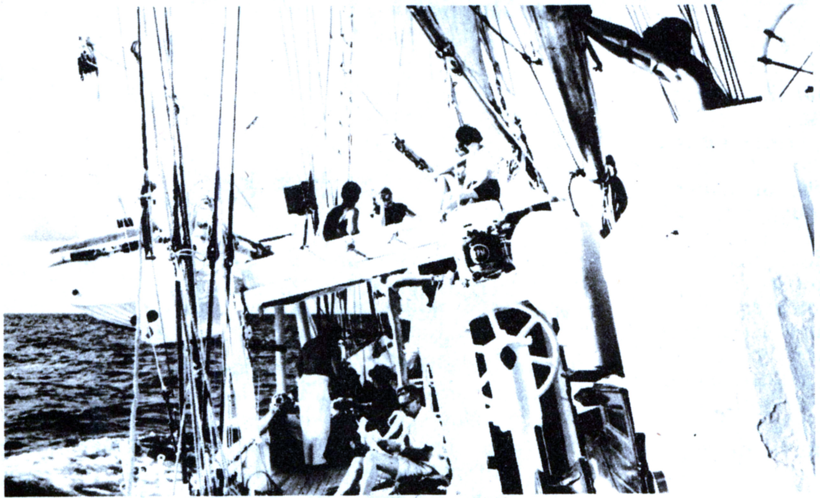
One player, the "Native", formulates a "Language" which consists of a set of rules for producing ordered strings of colored chips (Sentences). The remaining players, called "Querist-Theorists" or "QT's", attempt to understand the Language by asking whether specific strings of chips are Sentences of the Language (these yes-or-no answer questions are the "Queries" of the title). When a QT thinks he has a correct theory of the Language based on the Native's responses to the Queries, he so states and becomes the Linguist. Querying then stops and the remaining QT's affiliate with the Linguist if they think they have enough information to understand the Language; they affiliate with the Native if they believe there is not yet enough information available. The Linguist and his affiliates are each tested by asking them to predict whether or not strings constructed by the Native and his affiliates are Sentences in the Language. Payoffs are based on the complexity level of the Language and the number of Queries asked before testing begins. The Linguist wins if he gets all the Native's test questions correct; the fewer the number of Queries that were asked initially, the more points he gets from the Native. The Native wins if the Linguist does not predict all the test questions correctly; the more Queries, the greater the number of points. Side payoffs are also made involving the Native-affiliates and the Linguist-affiliates. The scoring system is complex; charts for assisting the calculations are included in the game.

This game is a very good simulation of the scientific process and students who work at it should be able to improve their "strong inference" abilities (see Platt, J. R., *Science, 146,* 347 (1964)). In my experience, however, the game is not easily learned, and in an initial 2 to 3 hour session, most students are only able to grasp the basic rudiments of the game. The instruction manual is itself over 50 pages long; about half of it is devoted to presenting the basic ideas and sample games in a programmed learning format. For greatest learning value, several playing sessions should be scheduled. As players gain experience, the complexity of the Language can be increased. There are also mechanisms for asking compound ("Strong") Queries. These features provide additional richness, so that players' interest and, therefore, learning continue as they play more games. I have worked mostly with a computerized version (unpublished) in which the computer plays the role of the Native. With it, student interest is somewhat unevenly distributed: Most students are either mildly interested or totally disinterested in the game; a smaller number do get hooked, sometimes but not always developing into good players. The game does require thinking; people who don't like to work at thinking won't enjoy it.

I would recommend the game to teachers who are interested in helping students develop their analytical abilities and to anyone who enjoys problem solving. It should be a useful supplement to any introductory course in the sciences at the high school or college level that includes a discussion of the scientific process. I have not used it in a linguistic context and thus cannot comment on its usefulness in this area.

Richard A. Cellarius
The Evergreen State College
Olympia, WA 98505

Take off your shoes.



Hit the deck in shorts and a tee shirt. Or your bikini if you want.

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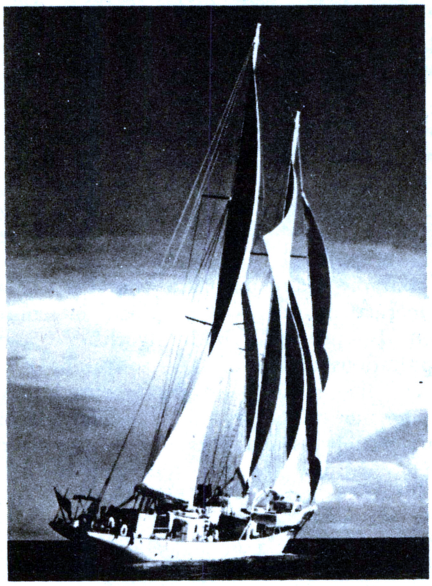

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Computer Lib / Dream Machines by Theodor H. Nelson, 128 pp. paper (oversize 11 x 14), $7.00. Hugo's Book Service, 1974. Revised edition 1976.

This is a very unusual book. Comments from university computer people I talked with have ranged from "the best book I've ever seen," which may be true, to "a book of gossip," which is certainly true. It resembles a *Whole Earth Catalog* in its general layout and teensy-weensy type. It is intended to give the total novice, as well as the more knowledgeable person, an idea of why computers do what they do as well as how they do it. Also, the matching T-shirts are now out and the movie is supposed to be on its way.

The front half of the book, *Computer Lib*, tells you in no particular order about where computer work is being done, who is doing it, how computer hardware works, how different types of computer hardware and software differ, how computer languages work, how computers are bought and sold, how some other computer-like things work, and what computers do and don't do, and several other things. All this is embedded in a mish-mosh of pictures, jokes, comments and other interesting goodies. The book lends itself to being dipped into for the interesting parts rather than to being read straight through. Three computer languages are introduced in a fairly good way: two familiar ones (Basic and APL) and one obscure one (Trac). These introductions are meant to give the reader an idea of what programming is like, not to give details, so if you were intending to get this book to learn Basic, don't.

The back half, *Dream Machines*, tells about the author's special interest, graphics. He goes into that the same way he attacked computers in general in the first half, and since this is a smaller field it gets more detailed. It also gets more complex. Since he has definite opinions on graphics, much more than on computers in general, the going can get kind of tough as he gives gruesome details about his favorite things.

He wraps up both halves of the book (in the middle, naturally) with his ideas of what computers, graphics, and people should be doing together, which are interesting in themselves.

Overall, the book has its strong and weak points. The author is no technical computer whiz, which is an advantage since he doesn't assume you are one either. On the other hand, the book has a wealth of trivial errors—the one comment attributed to me is something I never said. Nevertheless, this book is worth getting because you certainly won't find anything like it anywhere else. It's unique.

John Levine
New Haven, CT

*****

The Compleat Computer by Dennie L. Van Tassel, 216 pp. paper, $5.95. Science Research Associates, 1976.

The cover proclaims: "*The Compleat Computer* being a compendium of: Tales of the amazing & marvelous — Poetry — Informative news items — Articles for edification and enjoyment — Cartoons — Plus many other illustrations — with a special section of Splendiferous Science Fiction Art in full color." This in 7 different type faces and two colors, introducing, in my mind, one of the most diverse, interesting and mind-expanding computer books ever to hit print.

I boarded the American flight from Newark to Dallas in the early evening expecting to sleep most of the way, having been up much of the night before with a pregnant cat and cranky son. Most books put me to sleep and I made the mistake of assuming that this one would too. It didn't—Alistair MacLean, Isaac Asimov and John MacDonald move over. Dennie Van Tassel has asembled a fantastic bunch of articles and stories about the computer that would keep Rip Van Winkle alert and wide-eyed.

Setting the stage are a series of articles by what I call "popular" writers titled, by Dennie, "In the Beginning." He then follows with 14 hardware and 7 software pieces. I use the terms hardware and software loosely because Dennie has articles by Michael ("Terminal Man") Crichton, Ray ("The Martian Cronicles") Bradbury, Arthur C. ("2001") Clarke, and believe it or not, Art ("Ha!") Buchwald. C'mon now Buchwald, what do you know about that data processing stuff?

Stewart Brand drops in to talk about "Counter Computers" in the section, "The Present and Potential." Stewart, you'll recall, loyal *Creative* readers, does *CoEvolution Quarterly* and *Whole Earth Catalog* and *Epilogue* and that stuff.

Sections follow on "Applications," "The Impact," and "Governmental Uses" (ugh—not to the writers, but to Uncle—IRS, HEW, CIA, NCIC, GTH—Sam).

"Controls, or Maybe Lack of Controls" comes next with all the (usual) privacy stuff and more including an article "Man Bites Ford" from *Consumer Reports* (watch it, Dennie, you may have permission, but *CR* doesn't permit reprints even when they've given permission—they're suing us now—see you in jail).

Rounding out the book are some keen (40's), super (50's), fantastic (60's), bad (70's) articles on "The Future" (80's). (With one exception—but that's up to you to find).

My review may be on the light side but this is not a book to be taken lightly. It is a book assembled with great care, and a book that can (and should) well serve as the backbone of a computer literacy or computers in society course. Indeed, it should be required reading of every high school and college graduate today. After all, like it or not, the computer is now our constant companion, slave and nemesis, and one really ought to know about this fantastic force/animal/machine/intelligence — (select one or more).

Get a copy. Today!

David H. Ahl
Morristown, NJ

*****

The Elementary Functions: An Algorithmic Approach. G. Albert Higgins, Jr. 335 pp. Prentice-Hall, Inc. Englewood Cliffs, New Jersey 07632.

This book uses the idea of a computer program, and of the algorithm that it carries out, to develop the student's understanding of the idea of a function in general and of many specific elementary functions. It assumes that the reader has some ability to program computers (preferably, but not necessarily, in BASIC), but the reader will need few mathematical ideas beyond those found in elementary algebra and a smattering of elementary set theory. The idea of a function is developed in terms of algorithms for evaluating functions and doing other things to them.

Many of the ideas used are what one might call "geometric" or visually oriented. Some ideas from calculus are introduced including the idea of the area under a curve and of the slope of a curve at a point. But they are introduced in algorithmic clothes (e.g. by using the Trapezoidal Rule to actually compute areas).

The book contains many problems that use the results developed. Numerical answers and graphical interpretations are often given. By providing both algorithmic and geometrical interpretations of ideas that are usually portrayed only algebraically, the author manages to enrich a subject that may often appear rather dry. The considerable amount of historical material presented doesn't hurt in this respect either. But this is a fairly abstract treatment and it is not recommended for use in classes in which students are likely to ask "What is this good for?"

This book is suitable for a post-algebra, post-computing but pre-calculus course in either high school or college. It provides, as the author claims, a reasonable foundation for further work, not only in calculus but also in statistics and-or probability. It is well written.

John Cordeiro
Chestnut Hill, MA.

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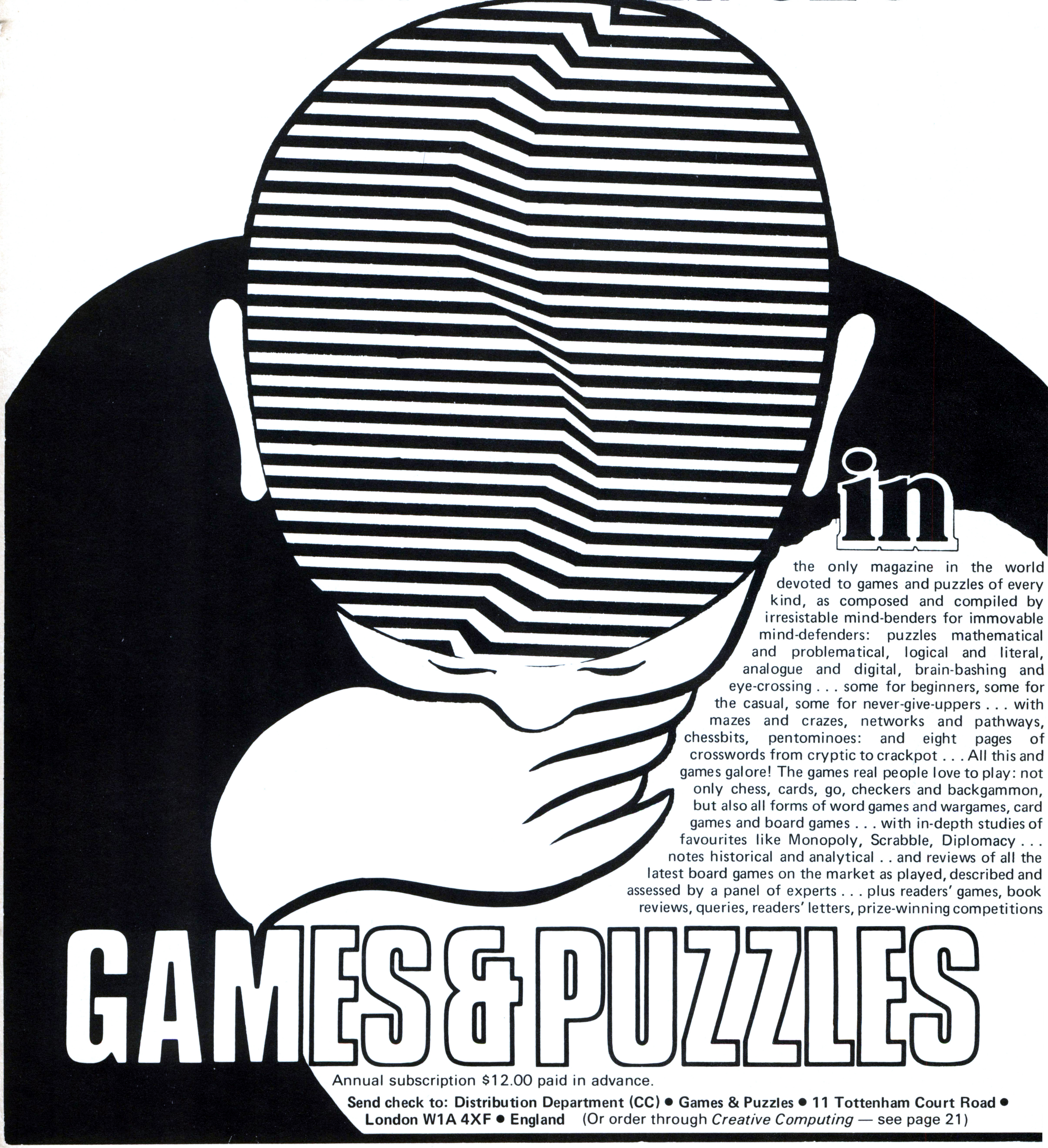
meet the mind•benders



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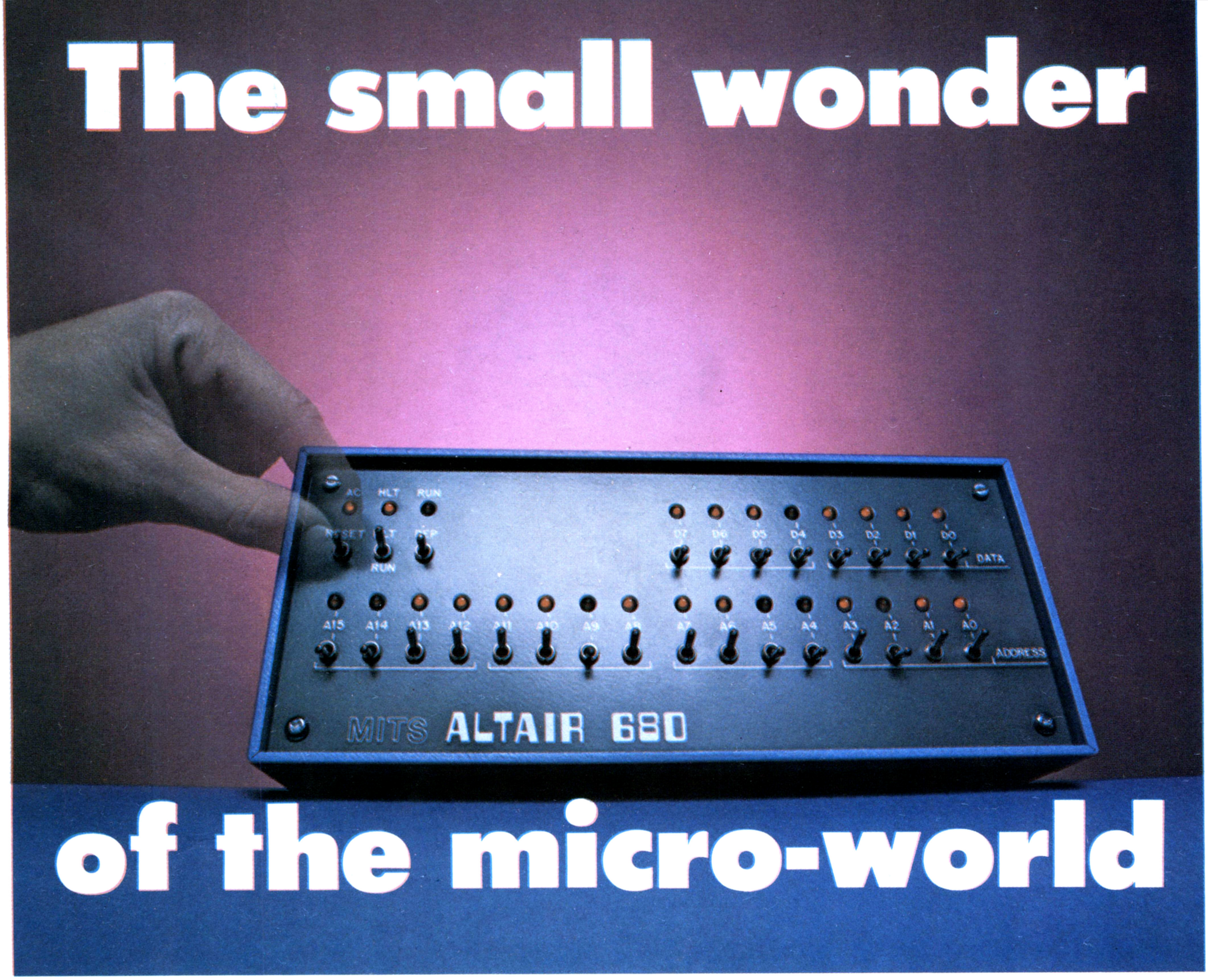

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Other software includes a resident two pass assembler.(also free with 16K board) The Altair 680b is also compatible with Motorola 6800 software.

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